Computational Nanotechnology

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Overview

Nanotechnology has led to significant innovations in the diverse areas of electronics, microcomputing, and biotechnology to medicine, consumer supplies, aerospace, and energy production. As progress in nanoscale science and engineering leads to the continued development of advanced materials and new devices, improved technology is required to achieve a more robust quantitative understanding of matter at the nanoscale. With the constant drive to miniaturize electronics, much of modern technology – from computer chips to sensor devices – involves components on a minute scale. To manufacture components hundreds of times thinner than a human hair, companies require electrical engineers with a new set of skills. Functional nanotechnology, nanoelectronics, nanofabrication, manufacturing, quantum engineering and producing nanomaterials such as graphene and carbon nanotubes are all key skills that need to be developed.

Engineering with Nanotechnology offers a firm grounding in conventional electronics, along with the specialist skills at the electronics/physics interface required to work on modern nanoscale device fabrication. The modules are built with the aim to cover computational aspects of nanoscale electronic devices, optoelectronics, nanofabrication and advanced experimental methods. The participants will be exposed to the latest advances through the up-to-date modules utilized for modelling nanomaterials using MATLAB and Finite Element methods.

The primary objectives of the course are as follows:

- Exposing participants to the fundamentals of computational nanotechnology
- Providing exposure to practical problems associated with fabricating nanoscale devices
- Revealing the computational aspects of nanotechnology in designing and fabricating devices

Lecture wise course plan (June 13-19, 2016)

Monday, June 13, 2016:

- **Lecture 1:** 9:00-10:00 am
  - Understanding the concepts of computational nanotechnology
- **Lecture 2:** 11:00-12:00 noon
  - Modeling at the Nano Level: Application to Physical Processes
- **Problem solving session 1** : Hands on tutorial: 2:00-4:00 pm

Tuesday, June 14, 2016:

- **Lecture 3:** : 9:00-10:00 am
  - Utilization of Finite Element Method in Nanotechnology,
- **Lecture 4:** 11:00-12:00 noon
  - Application of Matlab in nanotechnology
- **Problem solving session 2**: Examples based on Matlab : 2:00-4:00 pm

Wednesday, June 15, 2016:

- **Lecture 5:** 9:00-10:00 am
  - Nanorobotic Applications of Finite Element Method
- **Lecture 6:** 11:00-12:00 noon
  - Finite Element Method (FEM) for Nanotechnology Application in Engineering: Integrated Use of Macro-, Micro-, and Nano-Systems
- **Problem solving session 3**: Examples based on Finite Element method case studies: 2:00-4:00 pm

Thursday, June 16, 2016:

- **Lecture 7:** 9:00-10:00 am
  - Finite Element Method for Micro and Nano-Systems for Biotechnology
- **Lecture 8:** 11:00-12:00 noon
  - Computational Simulations of Nanoindentation and Nanoscratch
- **Problem solving session 4:** Examples based on the mechanical and biological systems:,2:00-4:00 pm

Friday, June 17,2016:

- **Lecture 9:** 9:00-10:00 am
  - Finite-Difference Time-Domain Method in Photonics and Nanophotonics
- **Lecture 10 :**11:00-12:00 noon
  - Computational of Optical Micro-/Nanoprism
- **Problem solving session 5**:Case studies based on photonics and nanophotonics: 2:00-4:00 pm

Saturday, June 18, 2016:

- **Lecture 11:** 9:00-10:00 am
  - Nanoscale Flow Application in Medicine
- **Lecture 12:** 11:00-12:00 noon
  - Boiling Heat Transfer and Critical Heat Flux Phenomena of Nanofluids
- **Problem solving session 6 :** Case studies based on nanofluids : 2:00-4:00 pm

Sunday, June 19, 2016

- **Examination and evaluation of participants :** 10:00 am – 1:00 pm

Modules	**A: Duration:** **June 13 – 19, 2016** **B: Venue** **Department of Chemistry, Jamia Millia Islamia (A Central University), New Delhi – 25, India** ***Number of participants for the course will be limited to fifty.***
You Should Attend If…	▪**You are an engineer/researcher/scientist from industry and government organization.** ▪**You are a faculty/student/research scholar of BTech/MSc/MTech/PhD from reputed academic institution interested in pursuing research career in computational nanotechnology/interested in working on data modeling and simulation using computational methods of simulation.**
Fees	The participation fees for taking the course is as follows: **Participants from abroad : US $200** **Industry/ Research Organizations: INR 5,000/-** **Academic Institutions:** ● **Faculty members: Rs. 2000/-** ● **Students: Rs. 1000/-** The above fee includes all instructional materials, tutorials and assignments. Participants will be provided accommodation on payment basis, subject to the availability.

The Faculty

Prof. Sarhan M. Musa is an Associate Professor of Engineering Technology at Prairie View A&M University (PVAMU) in Prairie View, Texas, USA, a senior member of the Institute of Electrical and Electronics Engineers (IEEE) and is also a LTD Sprint and a Boeing Welliver Fellow. He has been director of Prairie View Networking Academy, Texas, since 2004. Dr. Musa has published more than 100 papers in peer-reviewed journals and conferences. He has published 16 books and 7 book chapters which have also been best sellers with CRC process. He holds memberships of many reputed organizations. He is a frequent invited speaker on Engineering Technology, has consulted for multiple organizations nationally and internationally, and has written and edited several books. His research interests include: Computational Nanotechnology: Modeling and Application, Circuits and Systems, Numerical Modeling of Electromagnetic Systems, Computer Communication Networks, Optics and Photonics, Applied and Pure Mathematics. He has received more than 20 different State, National and International grants, research excellence awards, and honors all in the fields of Communication Systems, Computer Networking and Wireless Communication Networks, Circuits and Systems, Optics and Photonics, and Computational Nanotechnology.

Further details about Prof. S. M. Musa can be seen at his homepage: https://www.pvamu.edu/engtech/department-of-engineering-technology/faculty-staff-directory/dr-sarhan-m-musa/

Dr. Ufana Riaz is Assistant Professor in Materials Chemistry in the Department of Chemistry, Jamia Millia Islamia, New Delhi. She has actively worked on the development and other aspects of nanoscale conducting polymers. Dr.Ufana Riaz has published over 65 research papers in peer reviewed journals and has contributed 11 chapters in review books brought out by CRC press, Nova publishers and other publishers of repute. She has also coauthored three books. Dr Riaz has contributed significantly on the remediation of dyes from polluted water through microwave irradiation. She is presently working on the development of nanoscale modified conducting copolymers for application in bioimaging. Further details about Dr.Ufana Riaz can be seen at her homepage: http://jmi.ac.in/uriaz

Course Coordinator

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Course Registration Link:

http://www.gian.iitkgp.ac.in/GREGN