GIAN (MHRD) Course On
Multifunctional Complex Oxide Thin Film Heterostructures by Design
Duration: 20th to 30th March, 2018, at Jawaharlal Nehru University, New Delhi

Teaching Faculty

Prof. Chang-Beom Eom
University of Wisconsin-Madison, USA.

Prof. Eom is Theodore H. Geballe Professor and Harvey D. Spangler Distinguished Professor in the Material Science and Engineering program at the University of Wisconsin-Madison, USA. His research involves atomic-layer controlled heteroepitaxial growth of complex oxide thin films both by sputtering and pulsed laser deposition and the nanostructure fabrication of novel materials including piezoelectric, ferroelectric and multiferroics. He has been a renowned teacher and has developed interdisciplinary courses in advanced electronic materials processing and analysis.

Prof. Satyabrata Patnaik is a Professor at the School of Physical Sciences, Jawaharlal Nehru University, New Delhi. His area of specialization includes experimental condensed matter physics, particularly on synthesis and characterization of superconducting, multiferroic and thermoelectric materials.

Overview:
Complex oxides exhibit a wide range of structural, electronic, optical, and magnetic properties, and as such have proven fertile ground for the discovery of new phenomena that challenge our current understanding of condensed matter. As a result, they also present numerous opportunities for the development of novel, potentially paradigm-changing multifunctional devices to address our society's technology needs. To take full advantage of this fascinating class of materials, new theoretical and experimental approaches must be developed to elucidate fundamental principles, categorize competing interactions, and design and synthesize complex oxides with advanced functionalities. The course will cover the basic principles of thin film heterostructure design, atomic-layer controlled synthesis, atomic-scale structural and spectroscopic characterization, and the integrated theoretical/experimental development of design rules. A variety of specific device applications of novel multifunctional oxides will be discussed in detail.

Objectives:
The primary objectives of the course are as follows:

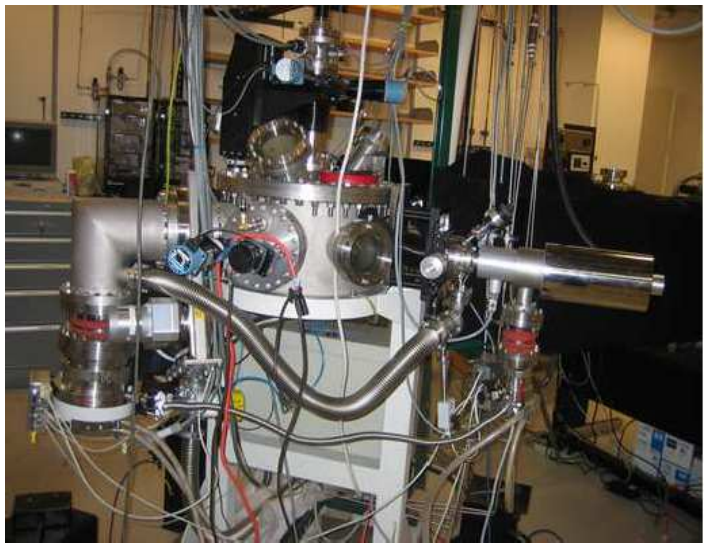
- To provide a comprehensive exposure to participants on design aspects of multifunctional devices derived from general principles of condensed matter physics.
- An extensive survey of thin film growth and characterization techniques.
- A summary of emerging research trends for materials towards addressing society's technology needs.

Who can attend:

- Students (BTech/MSc/MTech/PhD), Post doctoral fellows, Faculty members of Universities and Institutes, engineers and researchers from manufacturing and government organizations including R&D laboratories.

Venue:

- **School of Physical Sciences, JNU Campus, New Delhi**



Registration and fees ++

JNU M. Sc. students	**: Free**
JNU research students (M. Tech. & Ph.D.)	**: Rs. 1000**
JNU Faculty	**: Rs. 2000**
Other institutions (research students)	**: Rs. 2000**
Other institutions (faculty)	**: Rs. 4000**
Other government institutions	**: Rs.10000**
Industry and rivate institutions	**: Rs.15000**
Participants from outside India	**: US$ 500**

++ Accommodation is the sole responsibility of the participant. Few rooms will be offered on request, if available

Registration Steps:

(1). http://www.gian.iitkgp.ac.in/GREGN/index

(2). http://www.jnu.ac.in/GIAN

Course Schedule:

March 20 – March 30, 2018

Day 1: Lecture 1 (Two 1 hour lectures)

Introduction to multifunctional complex oxides

Day 2: Lecture 2 (Two 1 hour lectures)

Structure and basic properties of perovskite oxides

Day 3: Lecture 3 (Two 1 hour lectures)

Thin films synthesis of complex oxide thin films (Overview)

Day 4: Lecture 4 (1 hour lecture, 1 hour tutorial)

Atomic layer-by-layer controlled growth with in situ monitoring

Lecture 5 (1 hour lecture, 1 hour tutorial)

Fundamentals of Heteroepitaxy

Day 5: Lecture 6 (1 hour lecture)

Domain Engineering

Lecture 7 (1 hour lecture, 1 hour tutorial)

Atomic-scale structural characterizations (Advanced x-ray diffraction)

Day 6: Lecture 8 (1 hour lectures, 1 hour tutorial)

Atomic-scale structural characterizations (Scanning Transmission Electron microscopy)

Day 7: Lecture 9 (1 hour lecture, 1 hour tutorial)

Integration of multifunctional oxides on silicon

Day 8: Lecture 10 (1 hour lecture, 1 hour tutorial)

Multiferroics and Magentoelectric coupling Lecture 11 (1 hour

lecture) Ferroelectricity

Day 9: Lecture 12 (1 hour lecture, 1 hour tutorial)

Giant piezoelectricity and their applications

Lecture 13 (1 hour lecture)

2DEGs at complex oxide heterointerfaces

Day 10: Lecture 14 (2 hour lecture, 1 hour tutorial)

Epitaxial thin films of unconventional superconductors.

Day 11: (2 hour): Examination