Course Brochure

Global Initiative of Academic Networks (GIAN)

International Winter Course – 2017

on

Experimental Techniques for Nanomagnetic Materials – (ETNM 2017)

October 30-November 04, 2017

Organized by

Department of Physics

Motilal Nehru National Institute of Technology Allahabad

Allahabad 211004, India

Course Coordinator(s):

Dr. Arvind Agarwal : Principal Course Coordinator
Dr. Naresh Kumar : Course Coordinator
Dr. G. P. Sahu : Local GIAN Coordinator

Experimental Techniques for Nanomagnetic Materials – (ETNM 2017)

Overview

In last few years, a variety of magnetic materials have been explored from the different technological point of view and magnetism has become a central feature in condensed matter physics and subjects of various theoretical and experimental studies. At the same time, remarkable progress has been achieved in developing industrial applications of magnetism, and many kinds of magnetic materials were utilized for practical purposes. A charactersitic feature of magnetism is that theoritical and experiemental studies are performed in tight collaboration. In recent time, spintronics has attracted a considerable attention as a growing area in the field of magnetism. The modern devices based on spintronics requir nanoscale design facbrication techniques resulting nanomagnetism as an important and essential aspect of magnetism. The course titled "Experimental Techniques for Nanomagnetic Materials – (ETNM 2017)" will therefore be very much beneficial for the students, faculty members, researchers and those who are involved in industrial research on nanomagnetism.

The course attendees will learn through lectures; followed by hands-on training and tutorials on the subject. The course will also provide an ample opportunity for the participants to interact with the expert throughout the course.

Objectives

The primary objectives of the course are as follows:

i) Exposing participants to the fundamentals of magnetization
ii) Providing in depth understanding of various experimental techniques such as Mössbauer spectroscopy, Ferromagnetic resonance etc. used to study nanomagnetism
iii) Tutorials based on theme will be held for the exposure to practical problems based on the theme and their solutions.

Teaching Faculty

1. **Prof. Paulo Cesar De Morais (PCDM)** – Professor in School of Chemistry and Chemical Engineering, Anhui University, Hefei, China.
2. Dr. Arvind Agarwal (AA) – Associate Professor and Head, Department of Physics, M N N I T, Allahabad.
3. Dr. Naresh Kumar (NK) – Assistant Professor, Department of Physics, M N N I T, Allahabad.

Lecture Schedule: October 30-November 04, 2017

The course is divided into lectures, tutorials and/or hands-on training modules.

A. 10 Lectures of 1 hour each with following brief details

Lecture 1.: **Magnetization**: Instrumentation (VSM & Gouy balance); Phase transition; Hysteresis curves; FC-cooled & ZFC-cooled curves; Data modeling.

Lecture 2: **Ferrites:** Crystal structure and magnetic properties of spinel, garnets and hexaferrites.

Lecture 3.: **Magnetic susceptibility**: Instrumentation (susceptometer); Real & Imaginary components; Temperature-dependent experiments; Frequency-dependent experiments; Data modeling.

Lecture 4.: **Mössbauer spectroscopy**: Instrumentation (constant acceleration spectrometer); Hyperfine Interactions; Temperature-dependent experiments; Data modeling.

Lecture 5.: **Ferromagnetic resonance**: Instrumentation (EPR system); Temperature-dependent experiments; Angular-dependent experiments; Phase transition; Data modeling.

Lecture 6.: **Optical absorption**: Instrumentation (optical spectrometers); Band structure; Quantum confinement; Band gap renormalization; Data modeling.

Lecture 7.: **Raman spectroscopy**: Instrumentation (optical spectrometers); Crystal vibration; Molecular vibration; SERS experiments; data modeling.

Lecture 8: **Vibrating sample magnetometer**:Instrumenation, MH, MH loops of differenet magnetic materials.

Lecture 9: **Synthesis of Nanomaterials**:Instrumenation, physical, chemical and biological.

Lecture 10: **Synthesis techniques**: Spray Pyrolysis, Sol-Gel, laser ablation.

B. 05 Tutorials and/or hands-on training of 02 hour each with following details:

Tutorial 1.: **Units in magnetization**
Tutorial 2.: **Basic physics of magnetism**: Localized magnetism, The Weiss model, Ising systems.
Tutorial 3.: **Superparamagnetism in interacting systems**: Magnetization, Susceptibility, Scaling law.
Tutorial 4.: **Materials preparation**: Magnetic nanoparticles, Surface functionalization, Encapsulation (*ex situ* & *in situ*).
Tutorial 5.: **Materials preparation:** Laser ablation.

Evaluation

Participants will be evaluated through Assignmets/Quiz. After successful completion of the course, all participants will get participation certificates.

Number of participants for the course will be limited to Forty (40).

Who can attend

- Physicists, scientists, engineers, technicians and researchers involved with application or development of nanomagnetic/magnetic/functional materials.
- Student at all levels (B. Tech./M. Sc./M. Tech./Ph. D.) or Faculty from reputed academic and technical institutions.

Fees

The participation fees for taking the course are as follows:

Students	**: INR (Rs) 500/-**
Faculty/Researchers from Academic/Research Institutions	**: INR (Rs) 2500/-**
Participants from Industry	**: INR (Rs) 4500/-**
Participants from abroad	**: USD ($) 200/-**

The above fees include all instructional materials, computer usage for tutorials and assignments, and free internet facility.

All course registrations will be processed via the national GIAN portal (www.gian.iitkgp.ac.in), where **Rs. 500/- one-time fee is payable in addition to the above amount**.
Registration fee can be directly deposited by Demand Draft/Cheque, in favour of "***ETNM-2017***" payable at Allahabad OR National Electronic Funds Transfer (NEFT) to the account "***ETNM-2017***" (Account Number: 718400301000276) Bank: Vijaya Bank, MNNIT Branch, Allahabad-211004, UP, INDIA; IFSC Code: VIJB0007184

No TA, DA will be provided to the participants. Participants have to arrange their own accommodation and food. *However, limited shared accommodation may be made available (subject to availability) in the Institute Executive Centre/ Guest Rooms of Hostels on request on first come first serve basis. Payment for accommodation & food is extra as per actual.*
Last Date of Registration: October 28, 2017

About the Institute

Motilal Nehru National Institute of Technology Allahabad, Allahabad (MNNIT) is an Institute with total commitment to quality and excellence in academic pursuits. It was established as one of the seventeen Regional Engineering Colleges (Motilal Nehru Regional Engineering College, MNREC) of India in the year 1961 as a joint enterprise of Government of India and Government of Uttar Pradesh, and was an associated college of University of Allahabad. With over 45 years of experience and achievements in the field of technical education, having traversed a long way, on June 26, 2002 MNREC was transformed into National Institute of Technology with Deemed University status funded by Government of India. With the enactment of National Institutes of Technology Act-2007(29 of 2007), the Institute has been granted the status of institution of national importance *w.e.f.* 15.08.2007. The Institute now offers nine B. Tech., nineteen M. Tech. Degree Programmes (including part-time), MCA, MBA, M.Sc. (Mathematics and Scientific Computing) and Master of Social work (M.S.W.) programmes and also registers candidates for the Ph. D. degree.

About the Department

The **Department of Physics** came into existence in April, 2003. Prior to this it constituted a section of the Department of Applied Mathematics, Applied Sciences & Humanities. The Department offers Physics courses to all branches of B. Tech. students in their first two semesters. The Department is actively involved in experimental and theoretical research in the emerging areas of science and technology. The department offers Ph. D. programme and 25 students have obtained degrees.

How to reach MNNIT Allahabad

The Institute is located at about 8 km. from Allahabad Junction and Allahabad Bus Station, Allahabad and 4 km. from Prayag Railway Station. Cycle Rickshaw and Auto Rickshaw are the common mode of transport. Taxis are also available.. The charges are about `100/- for cycle rickshaw, `200/- for Auto rickshaw and `400.00 for Taxi.

Brief CV of Experts

Prof. Paulo Cesar De Morais, School of Chemistry and Chemical Engineering, Anhui University, Hefei, China. Prof. Paulo Cesar de Morais focuses mainly on nanomagnetic physics, nanotoxicity and nanosynthesis. Professor Morais held a two-years (1987-1988) post-doc with Bell Communications Research – USA and received his Doctoral degree from Federal University of Minas Gerais – Brazil in Solid State Physics (1986). He graduated in both Physics and Chemistry at the University of Brasilia – Brazil. Professor Morais is member of the Brazilian Physical Society, Brazilian Research Materials Society, American Physical Society, American Chemical Society (Physical Chemistry Division), and Institute of Electrical and Electronics Engineers - IEEE. He has served as referee for over 30 technical journals and has conducted research on nanomaterials in the past 30 years. He is known for his research on preparation, characterization and applications (industrial and biomedical) of magnetic nanoparticles and related materials systems (magnetic fluids, magnetoliposomes, magnetic nanoemulsions, and magnetic nanocomposites). He has published over 360 papers on indexed (ISI) technical journals and authored 15 patents. In recent years, Professor Morais presented over 100 invited talks worldwide. Currently, he acts as the coordinator and PI of several research projects (including three FP7 presently; two Marie Curie People and one Large), multi- and bilateral agreements with different countries (USA, Canada, Finland, Sweden, Ireland, Netherlands, France, Belgium, Italy, United Kingdom, Spain, Germany, Denmark, Switzerland, Poland, China, South Africa). Currently, he supervises graduate students, undergraduate students and postdocs.

Dr. Arvind Agarwal, Associate Professor, Department of Physics, MNNIT. Dr. Agarwal has obtained his Ph. D. in Physics from University of Allahabad, Allahabad, India. Dr. Agarwal had been awarded **JSPS Fellowship** "JSPS-DST Exploratory Exchange" under the Japan-India Cooperative Science Program for 2009 by Japanese Society for Promotion of Science (JSPS). He was Visiting Scientist, Institute of Physics, University of Brasilia. He was on Short-Term Visiting Fellowship (22) to several Japanese Universities including Chiba (6), Tokai(3) & Hirosaki(1). Visiting Fellow, ICTP (1989, 2004). Fellow, IAEA (2004). In his carrer spanning 34 years he has visited 28 laboratories abroad including 9 Synchrotron Radiadtion Sources. He has 90 reasearch papers to his credit and he attended 44 International/National Conferences and presented papers and delivered 13 invited talks/expert lectures in different Institutions/Universities around the world. He has Chaired Session on "Emerging Trends in applied and Material Sciences". Second International Conference (IEEE Sponsored) On Control Computing Communication and Materials (ICCCCM-2016). Dr. Agarwal has an interest in synthesis of functional Oxide nano materials, magnetic and multiferroic materials (Bulk and thin films) and understanding of their Physical (structural, electrical, magnetic and optical) properties. He has guided 05 Ph.Ds while one is working at present under his supervision. He has also completed one funded research project of ~Rs. 3.5 Lakhs. Dr. Agarwal has published and presented more than 84 research papers in different journals/proceedings of National and International Conferences. He has organized 04 different programs (International Conference, short term course, training, workshop etc.) He is life member of Indian Physics Association and Indian Association of Physics Teachers. He has delivered several radio talks on popular science topics.

Dr. Naresh Kumar, Assistant Professor, Department of Physics, MNNIT Allahabad. Dr. Kumar has obtained his Ph. D. in Physics from IIT Bombay. Dr. Kumar had been Brain Korea Post Doctoral Fellow at Inha University Incheon South Korea, Visiting scientist Centre INRS-EMT(Énergie, Matériaux, Télécommunications) Varennes (Québec Canada and lecturer at BITS Pilani India. Dr. Kumar has an interest in the synthesis of functional oxide nano materials, magnetic and multiferroic materials (Bulk and thin films) and understanding of their Physical (structural, electrical, magnetic and optical) properties. He has guieded 06 Ph.Ds (05 awarded and 01 submitted) while 02 are working at present under his supervision. Dr. Kumar has completed three exteranlly funded research projects of ~Rs. 60 Lakhs while one research project of ~ Rs. 13 Lakhs currently going on. Dr. Kumar has published/presented more than 68s research papers in different journals/proceedings of National and International repute. He has organized 10 different programs (International Conference, short term courses, training, workshop etc.) at MNNIT Allahabad as main coordinator/secretary and delivered 13 invited talks/expert lectures/presentations in Different Conferences/Institutions/Universities at South Korea, Singapore, Taiwan, Canada, Switzerland, France and India. Dr. Kumar had also served in various administrative capacities in MNNIT.

Contact Details

Principal Course Coordinator	Course Coordinator	Local GIAN Coordinator
Dr. Arvind Agarwal Associate Professor & Head Department of Physics Motilal Nehru National Institute of Technology Allahabad Allahabad - 211004, INDIA Tel: +91-9450952096 Email: arvind@mnnit.ac.in	Dr. Naresh Kumar Assistant Professor Department of Physics Motilal Nehru National Institute of Technology Allahabad Allahabad - 211004, INDIA Tel: +91-9454200193 Email: nsisodia@mnnit.ac.in	Dr. G.P. Sahu Associate Professor School of Management Science Motilal Nehru National Institute of Technology Allahabad Allahabad - 211004, INDIA Tel: +91-9305508002 Email: gsahu@mnnit.ac.in