

**Course Brochure**  
**Global Initiative of Academic Networks**  
**(GIAN)**  
**International Winter Course – 2017**  
**on**

**X-ray Absorption Spectroscopy and its Application to Nanomaterials**  
**(XASAN-2017)**

**December 21-28, 2017**

**Organized by**



**Department of Physics**  
**Motilal Nehru National Institute of Technology Allahabad**  
**Allahabad 211004, India**

**Course Coordinator(s):**

|                           |                                |
|---------------------------|--------------------------------|
| <b>Dr. Arvind Agarwal</b> | : Principal Course Coordinator |
| <b>Dr. Naresh Kumar</b>   | : Course Coordinator           |
| <b>Dr. G. P. Sahu</b>     | : Local GIAN Coordinator       |

# X-ray Absorption Spectroscopy and its Application to Nanomaterials (XASAN-2017)

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## Overview

Research activity in nanomaterials is triggering the appearance of different properties of the materials than their bulk counter part, suggesting a new pathway for the materials at nanoscale with engineered physical properties. There had been methods for solving the atomic structure of bulk crystals but failed for nanomaterials due to nanoscale effects. As a result, a local-structure characterization method for examining these nanostructures is very important and needed. In this course titled “**X-ray Absorption Spectroscopy and its Application to Nanomaterials**”, applications of X-ray absorption fine structure (XAFS) for determining several effects associated with the nanocrystalline nature of materials will be discussed therefore it will be very much beneficial for the students, faculty members, researchers and those who are working in this area.

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 objectives of the course are as follows:

- i) Exposing participants to the fundamentals of Nanomaterials and X-ray Absorption Spectroscopy.
- ii) Providing in-depth understanding of the applications of X-ray Absorption Spectroscopy to Nanomaterials.

## Teaching Faculty

1. **Prof. Takafumi Miyanaga (TM)** – Professor in Department of Mathematics and Physics, Faculty of Science and Technology, Hirosaki University, JAPAN.
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: December 21-27, 2017

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

### A. 6 Lectures of 1 hour each with following brief details

**Lecture 1.:** Physics of Nanomaterials

**Lecture 2.:** Introduction to X-ray Physics

2-1 Synchrotron radiation source

2-2 Interaction of X-rays with matter

**Lecture 3.:** X-ray Absorption Fine Structure (XAFS)

3-1 Measurement of XAFS

3-2 Theory of XAFS

**Lecture 4.:** Applications to Nanomaterials I

4-1 Structure of Te and Bi nanoparticles

4-2 Ag nanoparticles in luminescent zeolite and that on Si

**Lecture 5.:** Applications to Nanomaterials II

5-1 IMFP of EXAFS for studying nanoparticles

5-2 InGaN-LED and MgB<sub>2</sub> Super-conducting nano-films

**Lecture 6.:** Applications to Nanomaterials III

6-1 Magnetic materials: NiMn, Fe/Cr, FeRh

6-2 Phase transition on perovskite materials and chemical reactivity of Mo<sub>6</sub>O<sub>19</sub>, Mn<sup>n+</sup>(H<sub>2</sub>O)<sub>6</sub>

### B. 6 Tutorials of 1 hour each on above mentioned topics.

### C. 04 Tutorials of 1 hour each and 04 hours hands-on training on the growth of various nanostructures.

## Evaluation

Participants will be evaluated through Assignments/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:

|                                                                |                          |
|----------------------------------------------------------------|--------------------------|
| <b>Students</b>                                                | <b>: INR (Rs) 500/-</b>  |
| <b>Faculty/Researchers from Academic/Research Institutions</b> | <b>: INR (Rs) 2500/-</b> |
| <b>Participants from Industry</b>                              | <b>: INR (Rs) 4500/-</b> |
| <b>Participants from abroad</b>                                | <b>: USD (\$) 200/-</b>  |

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](http://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 "**XASAN-2017**" payable at Allahabad OR National Electronic Funds Transfer (NEFT) to the account "**XASAN-2017**" (Account Number: 718400301000277) 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:** December 20, 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. Takafumi Miyanaga**, is a Professor in Department of Mathematics and Physics, Faculty of Science and Technology, Hirosaki University, 3-Bunkyo-cho, Hirosaki, Aomori, 03608561 JAPAN. Prof. Miyanaga has got his Dr. Sc. from Osaka University Japan. He has exhaustive experience in applications of X-rays in materials science. Prof. Miyanaga has published more than 150 research papers in journals of International repute.



**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 career spanning 34 years he has visited 28 laboratories abroad including 9 Synchrotron Radiation Sources. He has 90 research 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 guided 06 Ph.Ds (05 awarded and 01 submitted) while 02 are working at present under his supervision. Dr. Kumar has completed three externally 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<br>Associate Professor & Head<br>Department of Physics<br>Motilal Nehru National Institute of<br>Technology Allahabad<br>Allahabad - 211004, INDIA<br>Tel: +91-9450952096<br>Email: arvind@mnnit.ac.in | Dr. Naresh Kumar<br>Assistant Professor<br>Department of Physics<br>Motilal Nehru National Institute of<br>Technology Allahabad<br>Allahabad - 211004, INDIA<br>Tel: +91-9454200193<br>Email: nsisodia@mnnit.ac.in | Dr. G.P. Sahu<br>Associate Professor<br>School of Management Science Mo-<br>tilal Nehru National Institute of<br>Technology Allahabad<br>Allahabad - 211004, INDIA<br>Tel: +91-9305508002<br>Email: gsahu@mnnit.ac.in |