Visvesvaraya National Institute of Technology (VNIT) Nagpur, Maharashtra, India

Department of Chemical Engineering

Report on the 7-day SERB-sponsored high-end workshop (KARYASHALA) on 'Hands-On Training and Workshop on Utilization of High-End Analytical Instruments' held during January 29 to February 4, 2024

The Department of Chemical Engineering, VNIT Nagpur, Maharashtra, India, hosted a 7-day high-end workshop (KARYASHALA) **on 'Hands-On Training and Workshop on Utilization of High-End Analytical Instruments,'** sponsored by the Science and Engineering Research Board (SERB) in offline mode from January 29 to February 4, 2024.

The KARYASHALA scheme is an effort by SERB, Government of India, through the Accelerate Vigyan scheme, to provide hands-on experience to students primarily from universities, colleges, private academic institutions, and newly established institutes in handling/troubleshooting high-end scientific instruments and developing skills on other themes required for research work.

The workshop brought together participants, including PG students, Ph.D. research scholars, and 4th-year undergraduate students from various universities/institutes/colleges, to expose them to state-of-the-art training in various advanced research instrumentation techniques. The main objective of the workshop is to provide the participants with advanced knowledge and hands-on training in various analytical techniques they will use during their research work. The program covered fundamental principles, sample preparation techniques, demonstrations, instrument selection with merits and demerits, and hands-on training on several advanced analytical instrumentation techniques, including microscopy, spectroscopy, electroanalytical tools, chromatography, deposition, calorimetry, and material analyses. Data analysis using software available at VNIT Nagpur was incorporated to build and strengthen participants' confidence in using high-end instruments for their research work. Furthermore, the week-long workshop served as an ideal platform for participants pursuing or intending to pursue research in diverse fields to come together, discuss, and disseminate their ideas and interests with the lead resource persons at VNIT Nagpur. The shared knowledge is aimed at contributing to our technical skills leading to economic prosperity and elevating the quality of life for the society.

Photograph taken during the inaugural program of high-end workshop, 29th January 2024

First row (left to right): *Dr. C. Ravikumar (Event Organizer and Coordinator), Dr. Diwakar Z. Shende (Coordinator), Prof. Pramod M. Padole (Chief Patron and Director of VNIT Nagpur), Prof. Sunil S. Bhagwat (Guest of Honor and Director of IISER Pune), Prof. Ajay K. Bansal (Chief Guest and Registrar of NIT Jalandhar), Prof. Kails L.Wasewar (Coordinator and Head of Chemical Engineering Dept.), Prof. Sachin A. Mandavgane and Dr. Pradip B. Dhamole (Faculty Colleagues).*

The 7-day workshop took place in the Chemical Engineering Department of VNIT Nagpur. The program was inaugurated by the chief guest, **Prof. Ajay K. Bansal**, Professor of Chemical Engineering and **Registrar** of Dr. B R Ambedkar National Institute of Technology, Jalandhar (**NIT Jalandhar**), Punjab, and the Guest of Honor, **Prof. Sunil S. Bhagwat**, **Director** of the Indian Institute of Science Education and Research (**IISER Pune**). The event was patroned by **Prof. Pramod. M. Padole**, the honorable **Director, VNIT Nagpur**, in the presence of deans, heads of various departments, distinguished speakers of the workshop, faculty colleagues, UG/PG, and Ph.D. scholars of VNIT Nagpur.

The Event Organizer and coordinator of the workshop, Dr. C. Ravikumar from the Chemical Engineering Department of VNIT Nagpur, delivered the introductory address outlining the workshop's purpose, objectives, analytical instruments to be covered, introduction of the speakers and lab sessions, and provided details about the event's schedule. Prof. Kailas L.

Wasewar, Head of the Chemical Engineering Dept. and coordinator of the workshop, briefly presented the activities of the Chemical Engineering Department. Professor P.M. Padole, the Director of VNIT, emphasized the range of facilities accessible at VNIT, particularly for instrumental analysis, and expressed the institution's commitment to further enhancing such capabilities. Professor Sunil S. Bhagwat, Director of IISER Pune, provided an in-depth discussion on the necessity of advanced instruments and their crucial role in national development. Professor Ajay K. Bansal, discussed the perception and significance of measurement techniques, stressing the importance of data accuracy achieved through suitable analytical methods. Dr. Diwakar Z. Shende, Coordinator of the workshop, extended gratitude through a vote of thanks.

A total of 14 lectures were delivered by 11 distinguished speakers from various Departments of VNIT Nagpur, including **Dr. Rajesh Khatirkar**, **Dr. Ravindra V. Taiwade**, **Dr. Ajeet K. Srivastav**, **Dr. Jatin Bhatt** and **Dr. D.R. Peshwe** of MME Dept., **Dr. Rajendra Patrikar**, and **Dr. Ganesh C. Patil** of Centre for VLSI and Nanotechnology, **Dr. Mahesh N. Varma**, **Dr. C. Ravikumar**, **Dr. Kailas L. Wasewar**, and **Dr. Diwakar Z. Shende** of Chemical Engg. Dept., covering principles, operations, and limitations of various advanced scientific instruments (16 in total). The topics ranged from Electrochemical Measurements to Thin film deposition techniques, High-energy ball mill, Powder X-ray diffraction, Scanning Electron Microscopy, Fourier-transform infrared spectrophotometer, UV-visible spectrophotometer, X-ray fluorescence Spectrometer, Atomic absorption spectrophotometer, High-Performance Liquid Chromatography, Raman Spectrophotometer, Gas Chromatography, Laser Particle Size Analyzer, Brunauer-Emmett-Teller (BET) Surface Area Analyzer, Microelectromechanical systems, High-temperature melting point apparatus, Differential Scanning Calorimeter/Thermogravimetry analysis, and Spin coating and dip coating techniques. Practical demonstration and hands-on training on all these instruments were provided to the participants in the respective laboratories of VNIT Nagpur. In addition to the instrument training, the participants had the privilege of visiting the V. R. Jamdar Siemens Centre of Excellence (valued at around Rs. 215 crore) to learn about the field of Industry 4.0.

A total of 25 participants (the maximum allowed to avail sponsorship by SERB) from various institutions such as Chaudhary Charan Singh Haryana Agricultural University, Hisar, (**Haryana**), Dr. N.G.P Arts and Science College, Coimbatore, (**Tamilnadu**), Sri Sathya Sai University for Human Excellence, Kalaburagi, (**Karnataka**), Vellore Institute of Technology,

Vellore, (**Tamilnadu**), Dr. B.R. Ambedkar National Institute of Technology, Jalandhar (**Punjab**), Pandit Deendayal Energy University, Gandhinagar, (**Gujarat**), Medi-Caps University, Indore, (**Madhya Pradesh**), Manipal Institute of Technology, Manipal, (**Karnataka**), National Institute of Technology Sikkim, (**Sikkim**), Bharati Vidyapeeth College Pharmacy, Kolhapur, (**Maharashtra**), Dr. Hari Singh Gour University, Sagar, (**Madhya Pradesh**), ICAR-Central institute of Agricultural Engineering, Bhopal, (**Madhya Pradesh**), CSIR National Metallurgical Laboratory, Jamshedpur (**Jharkhand**), Academy of Scientific and Innovative Research, Ghaziabad, (**Uttar Pradesh**), L.D. College of Engineering, Ahmedabad, (**Gujarat**), R.T.M. Nagpur University Nagpur,(**Maharashtra**), and CSIR-NEERI Nagpur, (**Maharashtra**) participated in the workshop.

Glimpses of photos taken during lectures and hands-on training

All the participants and distinguished speakers received a registration kit, which comprised a backpack, a writing pad, an event schedule, and a pen. All the sponsored participants were provided with daily necessary expenses, such as stationery, consumable items, food, refreshments, etc., throughout the entire 7-day duration of the event, along with the accommodation and reimbursement of travel costs (through the SERB fund).

The event was solely sponsored by SERB, a statutory body under the Department of Science and Technology, Government of India, New Delhi. The successful execution and seamless conduct of the workshop were made possible with the valuable assistance of research scholars from the Department of Chemical Engineering, namely Abhiram S. Yadav, Abhijeet S. Manwar, Anjali Dahat, Vaishnavi, Ashwini Thakre, Anjana Krishnan, G. Senthil, Roshan Burse, Tushar Maske, Shraddha Wadatkar, Pradip Kumar Ramteke, and Prachiprava Pradhan. Their contributions were instrumental in ensuring the workshop's success.

Photograph taken during the valedictory function of high-end workshop, 04th February 2024

First row (left to right): *Mr. Abhijeet S. Manwar (Research Scholar, Chemical Engg. VNIT Nagpur), Dr. C. Ravikumar (Event Organizer and Coordinator), Dr. Diwakar Z. Shende (Coordinator), Prof. Y.B. Katpatal, (Chairperson and Dean (R&C) of VNIT Nagpur), Dr. A. S. Khan (I.O.F.S), (Chief Guest and Officer In charge, National Academy of Defence Production, Ordinance Factory Ambazari, Nagpur), Prof. Kails L.Wasewar (Coordinator and Head of Chemical Engineering Dept.), Dr. Vijayakumar R.P. (Faculty Colleague), and Ashish Jain (Participant).*

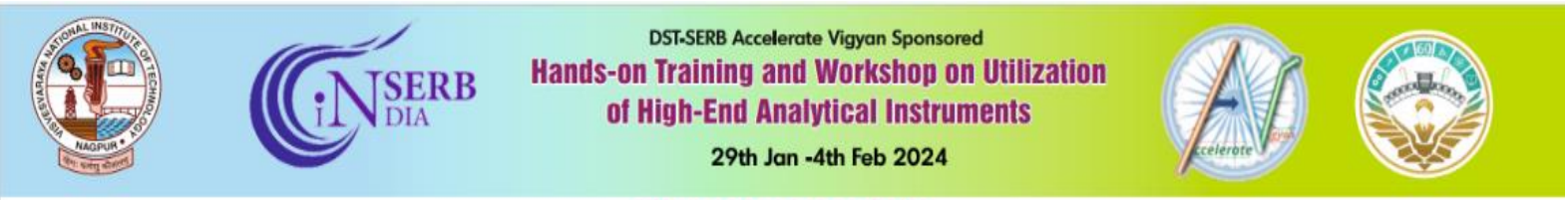
The valedictory function took place on 4th February in the August presence of the Chief Guest, **Dr. A. S. Khan (I.O.F.S)**, Officer In-charge, National Academy of Defence Production (NADP), Nagpur, presided over by **Prof. Y.B. Katpatal, Dean (R&C) VNIT Nagpur** along with their respective valuable addresses to the workshop coordinators, esteemed faculty

colleagues, Organizing Committee members, and the participants. During the ceremony, all the participants were rewarded with a participation certificate. Dr. C. Ravikumar provided a concise overview of the workshop, Prof. Kailas L. Wasewar gave a brief address on the Department's overall activities, and the vote of thanks was delivered by Dr. Diwakar Z. Shende.

Sincerely,

Dr. C. Ravikumar, Dr. Diwakar Z. Shende and Prof. Kailas L. Wasewar - Coordinators

Workshop Schedule



Tentative Schedule

Day	Lecture 9.30 am - 11.00 am		Lecture 11.15 am - 12.45 pm	Hands-on Training 02.15 pm - 3.45 pm	Hands-on Training 4.00 pm- 5.30 pm
Jan 29, 2024 (Monday)	Scanning Electron Microscopy (SEM) **Dr. Rajesh Khatirkar,** VNIT Nagpur		Powder X-ray diffraction (XRD) **Dr. Rajesh Khatirkar,** VNIT Nagpur	SEM demonstration, sample preparation, and characterization, result analysis **Dr. Rajesh Khatirkar,** VNIT Nagpur	XRD demonstration,characterization of powder samples, and result analysis **Dr. Rajesh Khatirkar,** VNIT Nagpur
Jan 30, 2024 (Tuesday)	Electron Beam Evaporation (EBE) and Thermal evaporation (TE) **Dr. Ravindra V. Taiwade** VNIT Nagpur		Microelectromechanical systems (MEMS) **Dr. Rajendra Patrikar,** VNIT Nagpur	Training on EBE and TE deposition techniques **Dr. Ravindra V.Taiwade** VNIT Nagpur	MEMS characterization, data analysis **Dr. Rajendra Patrikar,** VNIT Nagpur
Jan 31, 2024 (Wednesday)	Electrochemical Measurements (ECM) **Dr. Ajeet K. Srivastav,** VNIT Nagpur		High energy ball mill (HEBM) **Dr. D. R. Peshwe** VNIT Nagpur	Sample preparation, and training on ECM workstation, result analysis **Dr. Ajeet K. Srivastav,** VNIT Nagpur	HEBM- demonstration and sample characterization **Dr. Ajeet K. Srivastav,** VNIT Nagpur
Feb 01, 2024 (Thursday)	High-temperature melting point apparatus (MPA) **Dr. Jatin Bhatt** VNIT Nagpur	TEA BREAK	Differential Scanning Calorimeter / Thermogravimetry analysis) (DSC/TGA) **Dr. Jatin Bhatt** VNIT Nagpur	Demonstration and training on MPA, DSC, and TGA with result analysis **Dr. Jatin Bhatt** VNIT Nagpur	Visit to V.R. Jamdar Siemens Centre of Excellence lab- Smart Factory, Automation, CNC, Robotics, design software, and instruments **Dr. C. Ravikumar,** VNIT Nagpur
Feb 02, 2024 (Friday)	UV-Visible Spectrophotometer (UV-vis) & BET Surface Area Analyzer- **Dr. Kailas L. Wasewar,** VNIT Nagpur		Fourier-transform infrared spectrophotometer (FT-IR)&Atomic absorption spectrophotometer (AAS) **Dr. C. Ravikumar,** VNIT Nagpur	Hands-on training on UV-Vis, BET surface Area Analyzer with data analysis **Dr. Kailas L. Wasewar,** VNIT Nagpur	Sample Characterization using FT-IR and AAS with data analysis **Dr. C. Ravikumar,** VNIT Nagpur
Feb 03, 2024 (Saturday)	Gas Chromatography (GC) & High-Performance Liquid Chromatography (HPLC) **Dr. Magesh N. Varma** VNIT Nagpur		X-rayfluorescence (XRF) Spectrometer **Dr. Diwakar Z. Shende,** VNIT Nagpur	XRF demonstration and sample characterization and result analysis **Dr. Diwakar Z. Shende,** VNIT Nagpur	GC, HPLC training, and data interpretation **Dr. Kailas L. Wasewar,** VNIT Nagpur
Feb 04, 2024 (Sunday)	Spin coating and dip coating techniques (SC/DC) **Dr. Ganesh C. Patil,** VNIT Nagpur		Training and demonstration on Spin coating and dip coating techniques (SC/DC) **Dr. Ganesh C. Patil,** VNIT Nagpur	Laser Particle Size Analyzer- Lecture and demonstration and analysis **Dr. Diwakar Z. Shende,** VNIT Nagpur	Valedictory function- Brainstorming, feedback & certificate distribution