



One-Week Hands-On Training Program on “Nanostructured Materials and Devices: Fabrication, Characterization and Applications” (22<sup>nd</sup> July – 28<sup>th</sup> July, 2022)

The Department of Science and Technology, Government of India, has given the responsibility to IIT (ISM) Dhanbad to build human resources and its knowledge capacity using open access science and technology infrastructure through the scheme "*Synergistic Training Program Utilizing the Scientific and Technological Infrastructure (STUTI)*". Thus, under the DST-STUTI programme of IIT (ISM) Dhanbad, a one-week hands-on training program on "*Nanostructured Materials and Devices: Fabrication, Characterization and Applications*" was organized from 22<sup>nd</sup> July to 28<sup>th</sup> July, 2022 at Department of Physics, BIT Mesra, Ranchi, Jharkhand.

This training program was coordinated by Prof. Dilip Kumar Singh, Department of Physics, BIT Mesra and Prof. S. K. Sharma, Department of Physics, IIT (ISM) Dhanbad. This program includes thirty participants (Faculty/Research Scholar) from various universities/colleges in India.

Highlights of the Day-1 (Dated: 22<sup>nd</sup> July, 2022)

The first day of the training program began with a brief introduction to the program's purpose and significance. The introduction energized the participants' interest in science and engineering. Next, the training program was inaugurated. The participants were then given a welcome kit that included a note pad, a power kit (pen, pencil, eraser, and sharpener), and a program pamphlet.

Following that, two consecutive lectures were scheduled. The first lecture (from 11:00 AM to 12:15 PM) was based on the micro-cantilever printing of devices using TCAD and was delivered by Dr. Vimal Singh Yadav. The second lecture (from 12:15 PM to 01:30 PM) was based on the synthesis of nanomaterials using UV-Vis and was delivered by Dr. Sneha Singh.

Next, after the lunch break, a practical demonstration (from 02:30 PM to 05:30 PM) on TCAD simulation of nanoscale devices as well as synthesis of nanomaterials and UV-Vis absorption spectroscopy was provided by Dr. Vimal Singh Yadav and Dr. Sneha Singh.

Highlights of the Day-2 (Dated: 23<sup>rd</sup> July, 2022)

Similarly, on the second day, two lectures were conducted. The first lecture (from 10:00 AM to 11:15 AM) was focused on the spectroscopy of rare-earths based luminescent materials and was delivered by Prof. Kaushal Kumar. The second lecture (from 11:45 AM to 01:00 PM) was focused

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on the development of nanophosphors for optoelectronics applications and was delivered by Prof. S. K. Sharma.

Next, after the lunch break, a practical demonstration (from 02:0 PM to 05:0 PM) on CVD based growth of  $WS_2$  and nanowire was provided by Prof. Kausal Kumar and Prof. S. K. Sharma.

#### Highlights of the Day-3 (Dated: 24<sup>th</sup> July, 2022)

On the third day, two lectures were delivered. The first lecture (from 10:00 AM to 11:15 AM) was based on raman spectroscopy for the characterization of nanomaterials and was taught by Dr. Dilip Kumar Singh. The second lecture (from 11:45 AM to 01:00 PM) was based on the fundamentals of tribometry / multifunction tribometer and was taught by Dr. Gayatri Paul.

Following the lunch break, a laboratory demonstration (from 02:00 PM to 05:00 PM) on raman spectroscopy and multifunction tribometer was provided by Dr. Dilip Kumar Singh and Dr. Gayatri Paul.

#### Highlights of the Day-4 (Dated: 25<sup>th</sup> July, 2022)

On the fourth day, two lectures were given. The first lecture (from 10:00 AM to 11:15 AM) was focused on the optical and gas sensing properties of ion implanted tungsten oxide films and was delivered by Prof. Sunita Keshri. The second lecture (from 11:45 AM to 01:00 PM) was focused on optical coherence tomography (OCT) using nanoparticles and was delivered by Dr. Raju Poddar.

Next, after the lunch break, a laboratory demonstration (from 02:00 PM to 05:00 PM) on electrical measurements of nanoscale devices and optical coherence tomography was provided by Prof. Sunita Keshri and Dr. Raju Poddar.

#### Highlights of the Day-5 (Dated: 26<sup>th</sup> July, 2022)

Similarly, on the fifth day, two lectures were conducted. The transport property of nanostructures using impedance spectroscopy was the prime focus of the first lecture (from 10:00 AM to 11:15 AM) and was delivered by Prof. Sanjeev Kumar Rout. The surface spectral property of selected topological materials was the prime focus of the second lecture (from 11:45 AM to 01:00 PM) and was delivered by Dr. Rajyavardhan Ray.





Next, after the lunch break, a laboratory demonstration (from 02:00 PM to 05:00 PM) on impedance spectroscopy of nanostructures was provided by Prof. Sanjeev Kumar Rout and Dr. Rajyavardhan Ray.

Highlights of the Day-6 (Dated: 27<sup>th</sup> July, 2022)

On the sixth day, two lectures were given. The first lecture (from 10:00 AM to 11:15 AM) was based on advanced nanomaterials for energy storage applications and was taught by Dr. Abhay Desmukh. The second lecture (from 11:45 AM to 01:00 PM) was based on microfabrication and was taught by Dr. Richa Mishra.

Next, after the lunch break, some practical demonstrations (from 02:00 PM to 05:00 PM) of the sophisticated instruments (FESEM, XRD, AFM, etc.) were provided by Dr. Abhay Ddesmukh and Dr. Richa Mishra.

Highlights of the Day-7 (Dated: 28<sup>th</sup> July, 2022)

Similarly, on the seventh day (the last day of the training program), two lectures (the first lecture was from 10:00 AM to 11:15 AM and the second lecture was from 11:45 AM to 01:00 PM) were conducted based on the nanomaterial-based chemiresistors and texture analysis of nanoparticles for pharmaceutical applications. These two lectures were delivered by Dr. Pradip Kar and Dr. Sandeep Singh.

Next, after the lunch break, a laboratory demonstration (from 02:00 PM to 05:00 PM) on the fabrication of chemiresistors and characterization as well as texture analysis was provided by Dr. Pradeep Kar and Dr. Sandeep Singh.

Following that, the certificate distribution took place, followed by a closing speech. Throughout the training programme, a formal discussion environment was established for the exchange of scientific and technological knowledge.

  
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