MALAVIYA MISSION TEACHER TRAINING CENTRE
PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR

ज्ञान-विज्ञान विमुक्तये

Organized

REFRESHER COURSE IN PHYSICAL SCIENCES

15 to 31 – July, 2025

REPORT

Theme of Course/Program:	**Online Refresher Course in Physical Sciences**
Name of Course Coordinator	**Prof. Nameeta Brahme** **Professor,** **S.o.S. in Physics,** **Pt. Ravishankar Shukla University, Raipur**
Name of Course Coordinator from MMTTC:	**Dr. Arvind Agrawal** **Associate Professor** **Malaviya Mission Teacher Training Centre, Pt. Ravishankar Shukla University, Raipur**
Date of Course/Program:	**15.09.2025 to 31.09.2025**
Number of Participants:	**93**
Gender wise number of participants:	**Male – 09, Female – 11**
Number of Resource Persons	**20**

Organizing Team

Prof. Sachchidanand Shukla
Vice-Chancellor Pt. RSU, Raipur (C.G.)

Prof. Preeti K. Suresh
Director
MMTTC, Pt. RSU, Raipur (C.G.)

Prof. Nameeta Brahme
Professor, S.o.S. in Physics,
Pt. RSU, Raipur, (C.G.)

Dr. Arvind Agrawal
Associate Professor, MMTTC, Pt. RSU,
Raipur, (C.G.)

Refresher Course – Physical Sciences

(15.07.2025 - 31.07.2025)

Detail of date wise organized program

A Refresher Course on "Physical Sciences" was organized by Malaviya Mission Teacher Training Centre, Pt. Ravishankar Shukla University Raipur, in collaboration with S.o.S. in Physics, Pt. Ravishankar Shukla University, Raipur from 15th – 31st, July 2025. The coordinator of the course Prof. Nameeta Brahme, Professor, Physics, PRSU, Raipur, (C.G.). The course was attended by 20 registered participants from across the country. 05 outstation and 15 local participants attended the same. 20 resource persons delivered lectures.

INAUGURAL CEREMONY

Course Coordinator	Asstt. Course Coordinator
Prof. Nameeta Brahme	**Dr. G Nag Bhargavi**
Head SOS in Physics and Astrophysics Pt. Ravishankar Shukla University Raipur	Assistant Professor Dept. of Physics Govt. Pt. SCS College Dharsiwa

DAY: 01 (15.07.2025)

Session -I (10:30am to 12:00 noon)

The inaugural session of the **Refresher Course in Physical Sciences**, organized by **MMTTC**, Pt. Ravishankar Shukla University, Raipur, was held on **15th July 2025** in a vibrant and academic online gathering. The session commenced with a warm welcome of the **Honorable Vice-Chancellor, Prof. Sachchidananda Shukla**, by **Prof. Preeti K. Suresh**, Director-MMTTC, and **Dr. Arvind Agrawal**, Course Coordinator. **Prof. Preeti K. Suresh**, Director-MMTTC, delivered the welcome address. She extended greetings to all the dignitaries, resource persons, and participants and highlighted the objectives of the refresher course and its significance for faculty development. **Prof. Nameeta Brahme**, Course Co-ordinator, provided a **brief introduction to the Refresher Course**, outlining its academic goals, structure, themes, and the expected outcomes for the participants. She emphasized the interdisciplinary nature of the

course and its relevance to contemporary developments in Physical Sciences. The **Honorable Vice-Chancellor of Pt. Ravishankar Shukla University, Raipur, Prof. Sachchidananda Shukla**, delivered the **Inaugural Address**. In his inspiring speech, he stressed the importance of continuous learning, research innovations, and collaborative academic efforts. He appreciated the initiative taken by MMTTC in organizing such a vital academic program and encouraged participants to actively engage and contribute to the sessions. All participating faculty members briefly introduced themselves, sharing their institutional affiliations and academic interests. This segment fostered a sense of community and collaboration among attendees. **Dr. G. Nag Bhargavi**, Assistant Course coordinator, proposed the **Vote of Thanks**, expressing gratitude to the Honorable Vice-Chancellor, Director, Course Coordinators, technical team, and all participants for their presence and support in making the inaugural session a success. The inaugural program concluded with a short tea break, allowing informal interaction among the participants and organizers.

Chairperson/Reporter:-

(1) **Dr. Yugbodh Patle**

(2) **Dr. Jagdish Kumar Satyam**

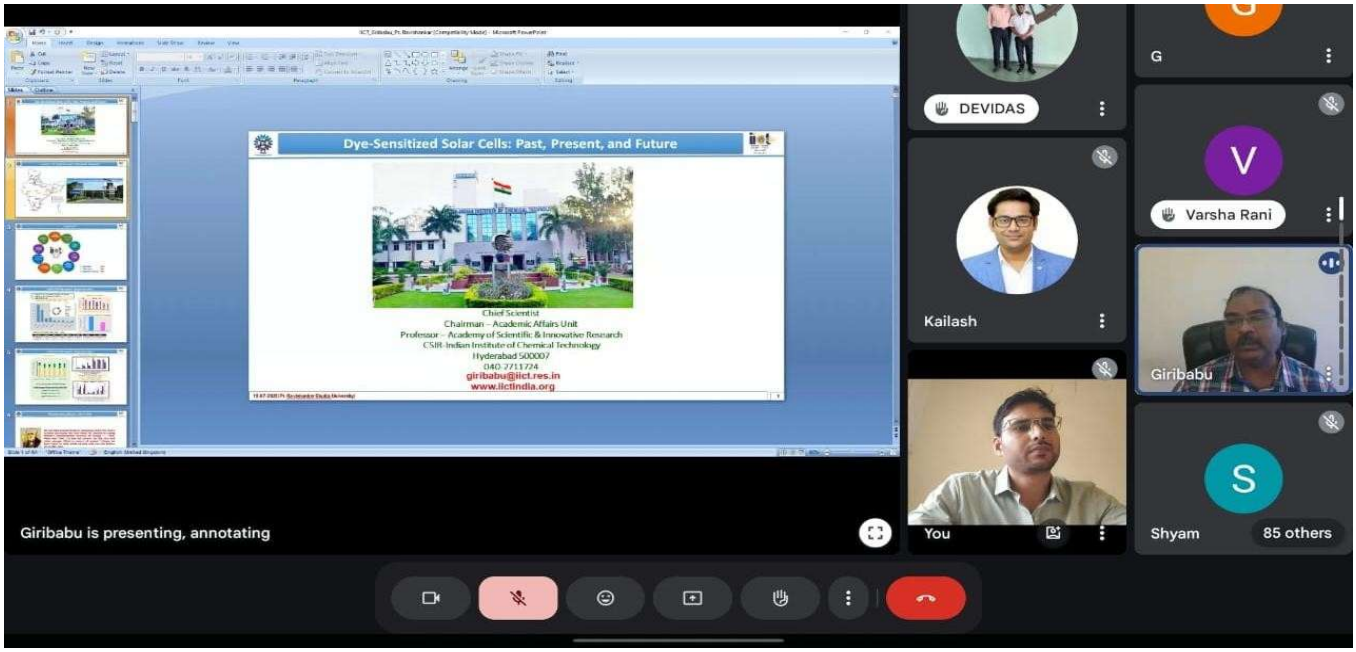
Session -II (12:15 to 13:45) Lecture -1

Speaker
Dr. Lingamallu Giribabu
Chief Scientist
CSIR- Indian Institute of Chemical Technology, Hyderabad

Title of Lecture- "Dye-Sensitized solar cells- past, present and future".

Dr. Giribabu delivered a comprehensive lecture titled "Dye Sensitized Solar Cell - Past, Present, and Future." The lecture covered various aspects of Dye-Sensitized Solar Cells, highlighting their potential as a sustainable energy solution. Dr. Giribabu began by providing a historical overview of solar cell technology, followed by an explanation of the basics of solar cells and the photovoltaic effect. He then delved into the detailed working mechanism of Dye-Sensitized Solar Cells, emphasizing their unique approach to light harvesting and charge separation, which mimics natural photosynthesis. A significant portion of the lecture was dedicated to the benefits of using porphyrins as sensitizers in Dye Sensitized Solar Cell. He also highlighted the advantage of Dye Sensitized Solar Cell in low-light conditions, where they can outperform traditional silicon-based solar cells, making them suitable for various indoor and diffuse light applications. Finally, Dr. Giribabu discussed the current market demand for Dye Sensitized

Solar Cell, noting their growing adoption in diverse applications such as portable consumer electronics, and automotive integration. He concluded by outlining the promising future applications, driven by ongoing research and development aimed at improving efficiency, stability, and cost-effectiveness.



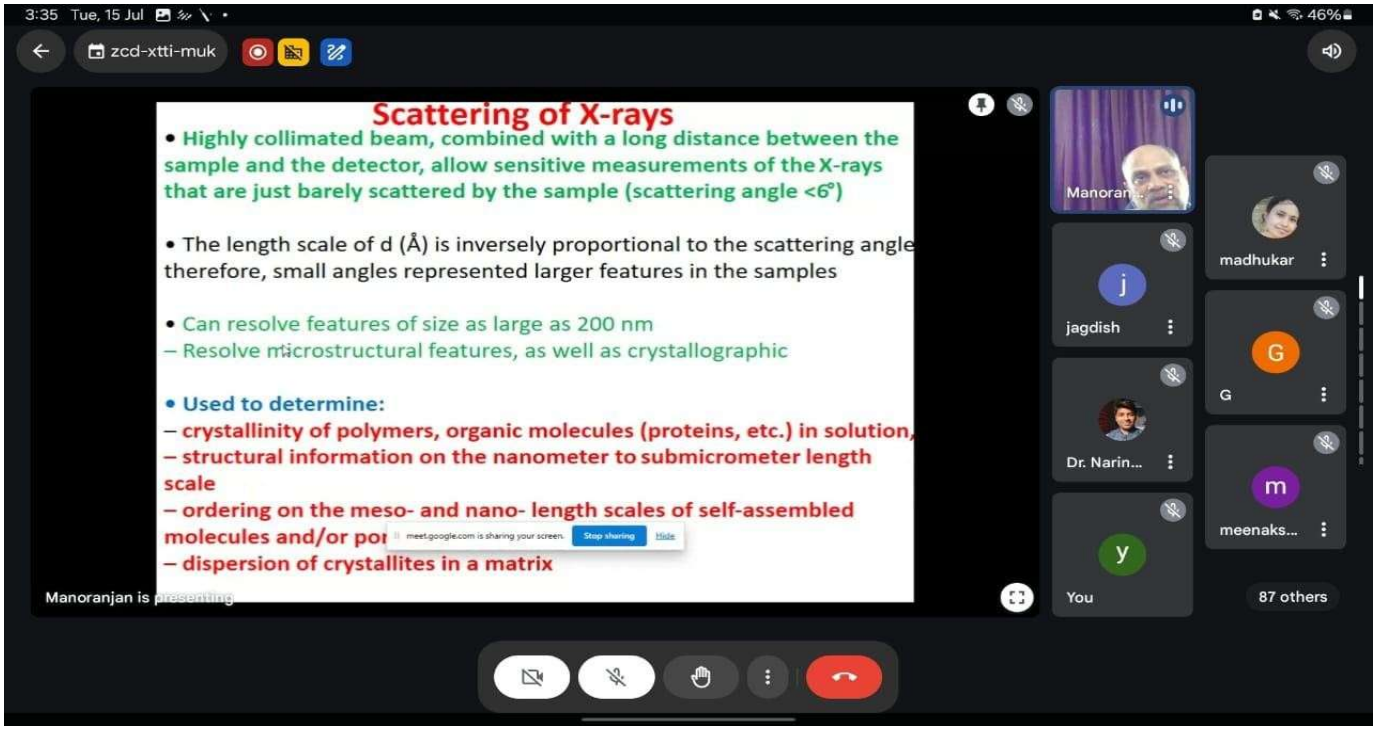
Session – III (14:15 to 15:45) Lecture -2

Speaker
Dr Manoranjan Kar
Associate Professor
Indian Institute of Technology, Patna

Title of Lecture- "X-Ray: A Tool for Material Characterization."

Dr. Manoranjan Kar presented a lecture titled "X-Ray: A Tool for Material Characterization." The presentation focused on the fundamental principles and applications of X-ray techniques in material science.Dr. Kar began by explaining the fundamental reasons for using X-rays in material characterization, primarily highlighting their short wavelength, which makes them ideal for probing atomic and molecular structures within materials. He discussed how X-rays interact with matter, leading to phenomena like scattering of X-ray light, which forms the basis of various analytical techniques. A significant portion of the lecture was dedicated to the concept of line broadening in X-ray diffraction (XRD) patterns. Dr. Kar elaborated on how factors such as crystallite size, lattice strain, and instrument effects contribute to the broadening of diffraction peaks. He then introduced the methodologies for determining crystallite size using Sherrer's formula and Williamson-Hall plot. The lecture provided a comprehensive overview of how

X-ray techniques serve as an indispensable tool for understanding the structural characteristics of various materials.



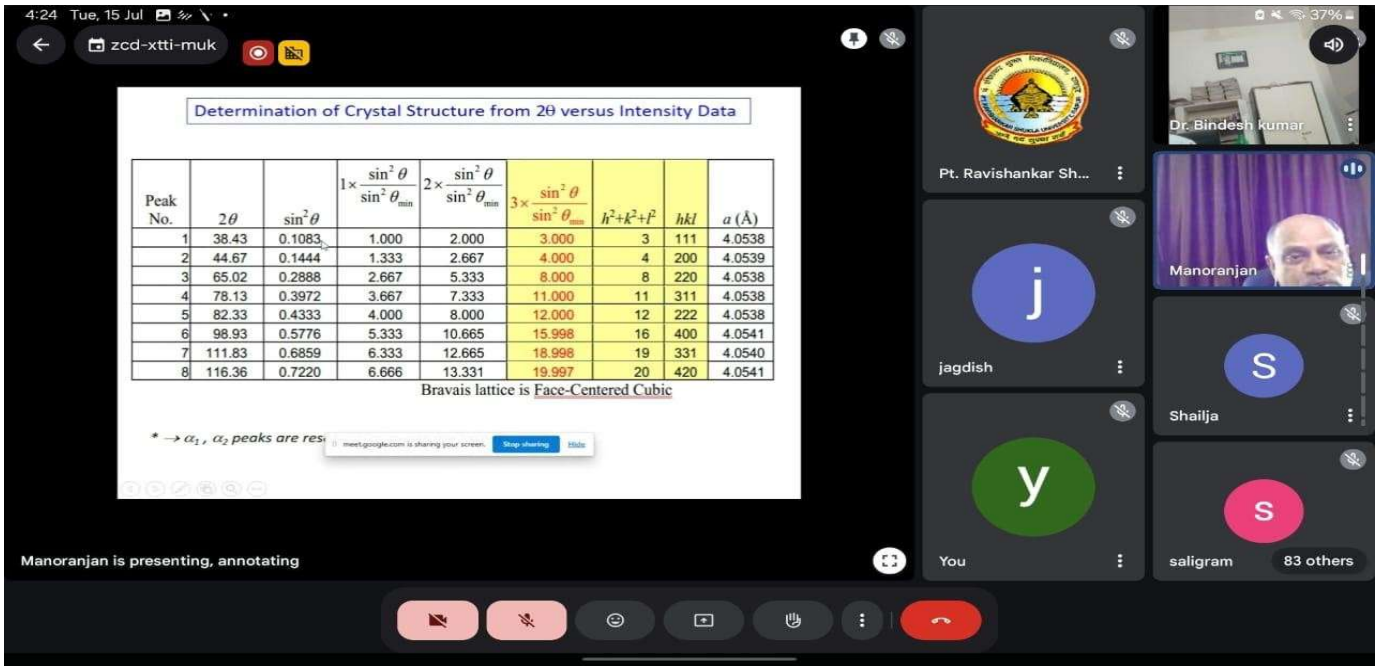
Session – IV (16.00 to 17:30) Lecture -3

Speaker Name-
Dr Manoranjan Kar
Associate Professor
Indian Institute of Technology, Patna

Title of Lecture- "Rietveld Method: A Tool to Extract the Crystal Structure Parameters from XRD Patterns."

Dr. Manoranjan Kar presented a lecture titled "Rietveld Method: A Tool to Extract the Crystal Structure Parameters from XRD Patterns." The lecture focused on the Rietveld refinement technique, a powerful method for analyzing X-ray Diffraction (XRD) data. . He emphasized its utility in extracting detailed structural information from complex XRD patterns. He then delved into the fundamental crystallographic concepts of **Bravais lattices and h,k,l values** (Miller indices). Dr. Kar elaborated on how these indices represent the orientation of crystallographic planes and are crucial for understanding the diffraction peaks observed in XRD patterns. Dr. Kar explained how the position and intensity of diffraction peaks in an XRD pattern are unique fingerprints of a material's crystal structure. He illustrated how Rietveld refinement utilizes this data to extract parameters such as lattice parameters, atomic positions, site occupancies, and

even thermal parameters. Finally, Dr. Kar provided insights into the practical application of **the Rietveld refinement method**, including the steps involved in setting up a refinement and interpreting the results. He specifically touched upon **how FullProf works**, describing it as a widely used software suite for Rietveld refinement, capable of handling various types of diffraction data (X-ray, neutron, and electron) and accommodating complex magnetic and crystallographic structures. The lecture provided a comprehensive overview of the Rietveld method as an essential tool for advanced material characterization.



DAY: 02 (16.07.2025)

Chairperson/Reporter:-

(1) Dr. Vijay Sharma

(2) Mrs. Rashmi Priya Toppo

Session -I (10:30 am to 12:00 pm) Lecture -4

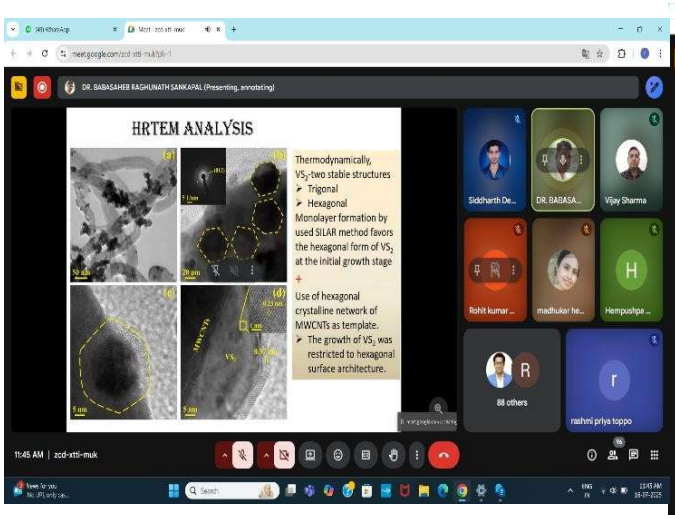
Speaker
Dr. Babasaheb Raghunath Sankapal
Professor Dept. of Physics VNIT Nagpur

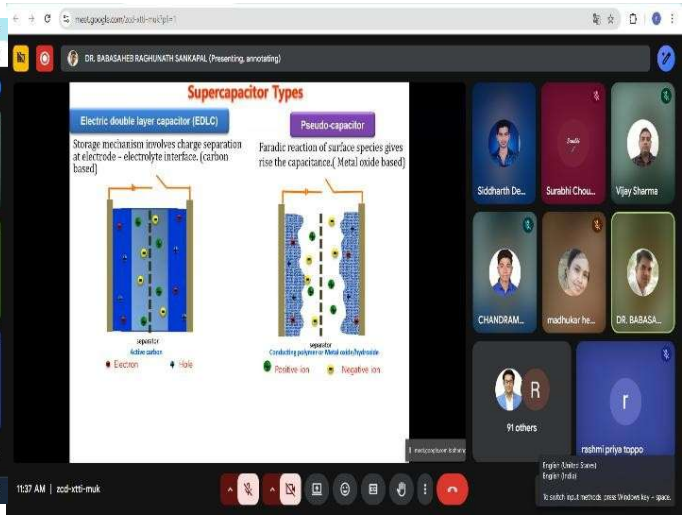
Title of Lecture- Energy Materials: Conversion and Storage Devices through Chemical Routes

Dr. Babasaheb Raghunath Sankapal, Professor at VNIT Nagpur, delivered an insightful lecture on low-cost chemical synthesis of energy materials for solar cells and supercapacitors. He emphasized the importance of selecting impactful research topics and shared his achievements, including seven completed and three ongoing projects with total funding of ₹2.84 crore. His team's success is reflected in strong publication metrics and global researcher rankings.

He explained how reducing material size to the nanoscale alters properties due to quantum confinement, especially in quantum dots like PbS. Highlighting bottom-up synthesis methods, he demonstrated their cost-effectiveness and suitability for flexible devices. His work on dye-sensitized solar cells (DSSCs) and quantum dot-sensitized solar cells (QDSSCs) showed efficiencies of 3.5% and ~6% respectively, with innovations in transparent and flexible device design.

Dr. Sankapal also presented advancements in supercapacitors using CNTs coated with metal oxides, achieving excellent energy storage performance and device stability. He stressed the need for commercialization of lab research, clear proposal writing, and structured publications. The lecture concluded with an engaging Q&A session. Prof. Vijay Sharma thanked Dr. Sankapal for his impactful and application-driven presentation.





Session -II (12:15 to 13:45) Lecture -5

Speaker

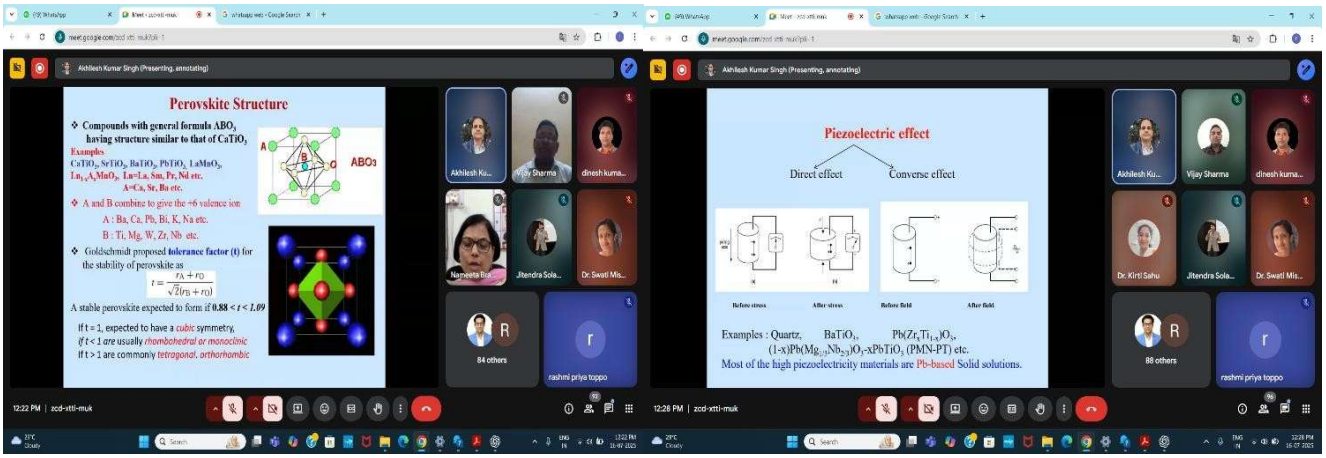
Dr. Akhilesh Kumar Singh
Professor
School of Materials Science and Technology
IIT BHU

Title of Lecture- Novel Multifunctional Materials for Sensors and Energy Applications.

Dr. Akhilesh Kumar Singh, Professor at IIT BHU, delivered a detailed lecture on multifunctional materials for energy and sensor applications. Introduced by Prof. Vijay Sharma, Dr. Singh began by outlining the scope of material development and characterization, focusing on dielectric and ferroelectric ceramics, nanomaterials, and particularly perovskite structures. He explained how perovskite materials, both organic and

inorganic, exhibit structural adaptability influenced by tolerance factors, making them idealfor solar cells and energy devices. A significant portion of the lecture focused on piezoelectric materials like PZT and PMN-PT, describing their working principles and relevance in medical and energy-harvesting applications, alongside the environmental shift toward lead-free alternatives.

Dr. Singh also covered advanced topics such as Rietveld refinement, crystal symmetry, and phase coexistence, linking structural transitions with functional properties like polarization and energy storage. He presented innovative work on molybdenum-doped lead titanate for ferroelectric photovoltaics, and bismuth- and lithium-doped barium titanate for enhanced energy storage. His group's PVDF-based nanocomposites demonstrated notable dielectric and energy density improvements, resulting in two patents. The session concluded with a Q&A, where Dr. Singh addressed technical queries, followed by a vote of thanks by Rashmi Priya Toppo, acknowledging the session's value to cutting-edge research in multifunctional materials.



Session -III (14:15 am to 15:45 pm) Lecture -6

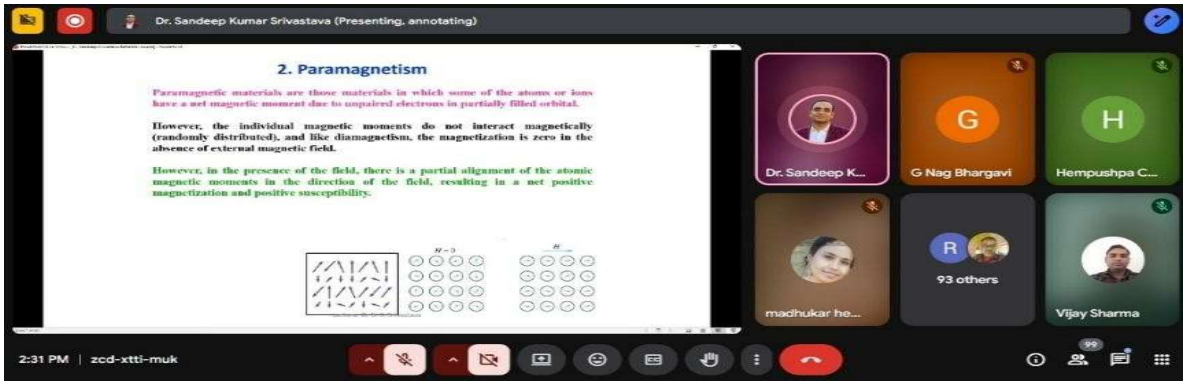
Speaker
Dr. Sandeep Ku. Srivastava
Associate Professor
CIT Kokrajhar

Title of Lecture- Fundamental to Application in Storage Devices.

Dr. Sandeep Kumar Srivastava, Associate Professor at CIT Kokrajhar, delivered an informative lecture on magnetic materials and their relevance in modern storage technologies. Introduced by Prof. Vijay Sharma, Dr. Srivastava began by reviewing the fundamental types of magnetism-diamagnetic, paramagnetic, ferromagnetic, antiferromagnetic, and ferrimagnetic-explaining their atomic origins and temperature dependencies. He clarified coercivity-based applications, differentiating hard and soft ferromagnets.

The talk transitioned to domain structures such as Bloch and Néel walls, and nanoscale effects including enhanced magnetic moments and quantum confinement in nanostructures like thin films, nanowires, and grains. Dr. Srivastava detailed key characterization techniques like VSM, SQUID magnetometry, and the Extraordinary Hall Effect (EHE), linking these to temperature-dependent magnetic behavior and material performance.

In application, he discussed the evolution of magnetic storage-from early devices to modern high-capacity media-and highlighted bit-patterned storage as a future path toward miniaturization. He presented his group's work on Fe-Pt-Co alloy thin films synthesized via DC sputtering, demonstrating in-plane magnetic anisotropy and high Ku. Concluding with insights into D^0 ferromagnetism and spintronics, he showcased Ag-doped SnO_2 as a promising room-temperature magnetic semiconductor. The session ended with a Q&A, collaborative invitations, and expressions of gratitude for an enriching lecture.



Session -IV (16:00 am to 17:30 pm) Lecture -7

Prof. Ramakrishna N. Rao
Professor
Dept. of Physics
Andhra University, Visakhapatnam

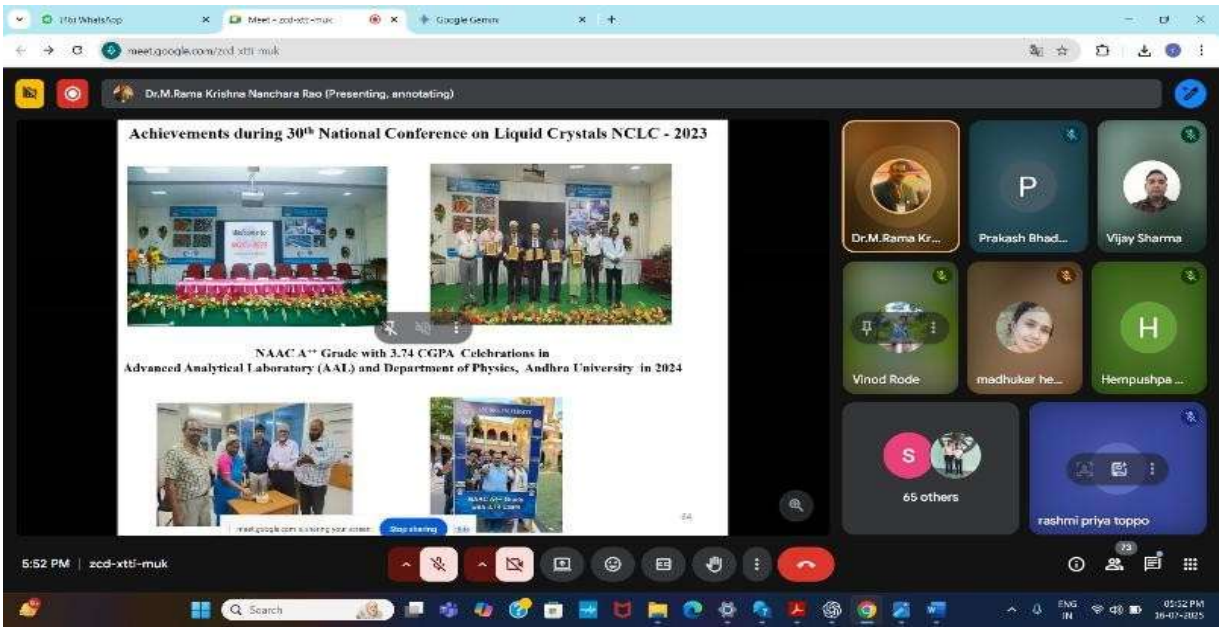
Title of Lecture- Influence of nanoparticles dispersed in Liquid Crystalline compounds -Optical and electrical studies

Dr. Ramakrishna Nanchara Rao, Professor at Andhra University, delivered a rich and insightful lecture on nanoparticle-enhanced liquid crystals and their role in energy materials.

Introduced by Dr. Vijay Sharma, the session began with an overview of liquid crystals (LCs), highlighting their mesophase behavior between liquids and solids. He explained various LC types-thermotropic and lyotropic-along with key phases like nematic, smectic, and crystalline textures, each significant for display and optical applications.

Dr. Rao detailed the impact of nanoparticle dispersion in LCs, particularly in enhancing viewing angles and birefringence, vital for medical and optical devices. He described synthesis techniques such as the autoclave method for ZnO and chemical reduction for gold nanoparticles, emphasizing the role of capping agents in stability. Characterization tools included UV-Vis, SEM, XRD, DSC, and POM.

Advanced techniques like GMSD and MATLAB-based signal processing for clean DSC analysis were introduced, along with optical methods to quantify birefringence. Dr. Rao showcased cutting-edge applications like reconfigurable LC antennas with tunable frequencies, supporting next-gen communication systems. He concluded by encouraging young researchers to embrace interdisciplinary innovation and resilience. The session ended with an engaging Q&A and warm appreciation for his inspiring contributions to science and education.



DAY: 03 (17.07.2025)

Chairperson/Reporter:-

(1) Dr. S Ramkrishnan

(2) Shri Shyam Sundar Tiwari

Session -I (10:30 am to 12:00 pm) Lecture -8

Speaker

Prof D Harnath

Professor Dept. of Physics NIT Warangal

Title of lecture -Powering the future with simple and smart technology

about smart material

- Classification of smart material
- Component of smart material
- Why need of new material
- Explain by video about need
- Need of energy harvesting
- Explain about nanogenerator its types and main focus on triboelectric nanogenerator
- Explain fabrication, working its stability and photoluminescence with various example of TENG

Session -II (12:15pm to 1:45 pm) Lecture -9

Speaker

Dr. Debangsu Roy

Assistant

Professor IIT

Ropar

Title-Basics of Magnetism

- Magnetic dipole and compare with electric dipole moment
- Force exerted on a charge particle, Right hand rule
- Motion of charge in magnetic field, Magnetic force on current carring coil
- Explain about Lorentz's force
- Electromagnet, Solenoid and its working, Different types of magnetic materials
- Magnetic flux, Hysteresis curve with all magnetic materials
- Magnetic hard drive and how the read and write

Session -III (2:15pm to 3:45 pm) Lecture -10

Speaker

Dr. Jyoti prasad Borah
Associate Professor
NIT Nagaland

Title-magnetic material for Energy Application; Fundamental and Emerging trends nanomagnetism for the hyperthermia

Explain on the basis of domain theory

Magnetic material for hyperthermia

Nano magnetism for the hyperthermia

Heat loss magnetism, Super para magnetism, Hexaferrite

Spintonics , 2d magnetic material skyrmions

Session -IV (4:00pm to 5:30 pm) Lecture -11

Speaker

Dr. V Sivakumar
Associate Professor

Title- **Luminescent materials; fundamental to application**

- use of phosphor
- Basic of luminescence
- Classification of luminescence
- Explain selection rule
- Inorganic phosphor, lamp,blue, green red phosphor ,cathode ray phosphor
- Solid state lighting LED explain its history
- Gallium nitrate based led for white light
- Phosphor requirement garnet a3b2c3o12
- Explain spectral tuning and thermal quenching method . Red and White LED fabrication
- Thermal stability energy level diagram for different material
- How Molecular engineering for solid and solution
- Quntum dot for biological purpose and nano chemstry
- Semiconductor material and its application

DAY: 04 (18.07.2025)

Chairperson: Mr. Dinesh Kumar Chitriv
Reporter: Mr. Ajay Kumar Sharma

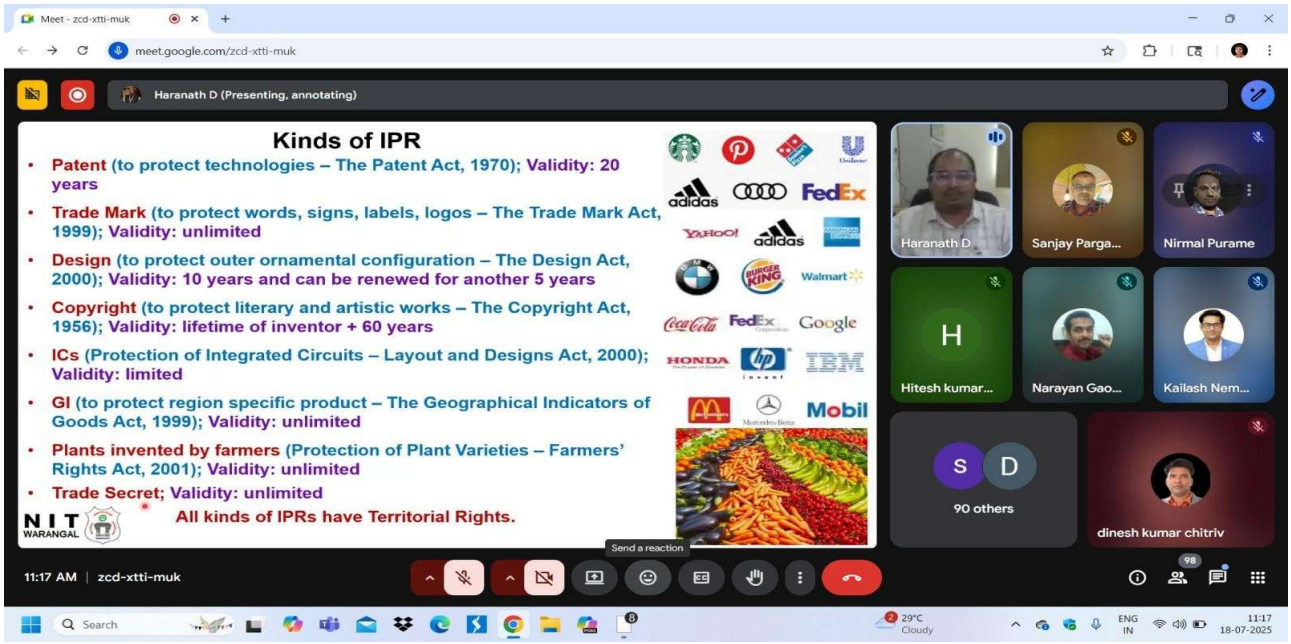
Session -I (10:30 AM to 12:00 PM) Lecture-12

Speaker
Prof. D. Haranath
Professor
Department of Physics, NIT Warangal.

Title of Lecture- "IPR fundamentals and Patent Drafting Skill for Everyone"

The session aimed at enhancing awareness and understanding of Intellectual Property Rights (IPR), particularly focusing on the basics of patents and the methodology of patent drafting.

Prof. Haranath began the session by introducing the concept of Intellectual Property and its growing significance in academia, research, and industry. He explained that IPR is a legal framework designed to protect the creations of the human intellect—whether in the form of inventions, designs, literary works, trademarks, or innovations in technology.



He elaborated on the various types of IPR including patents, copyrights, trademarks,
Design, trade secrets and GI etc, emphasizing how they serve to protect innovations and foster creativity. He stressed that IPR not only provides legal protection but also acts as a **catalyst for innovation**, enabling inventors and organizations to benefit commercially from their creations. He also emphasized that **researchers must recognize patentable aspects** of their work and take steps to protect them before publishing. Often, groundbreaking research results go unpatented simply because of lack of awareness, resulting in lost opportunities for commercialization or licensing.

Prof. Harnath presented the step-by-step breakdown of the patent filing process including idea conceptualization and documentation, prior art search to assess novelty, drafting of the **patent specification,** filing with the appropriate patent office, Patent examination and response to objections, Grant or rejection.

The heart of the session focused on **patent drafting skills**, which are crucial for protecting one's invention effectively. He shared examples from real patents, discussed how scientific innovations can be translated into legally sound patent claims, and provided tips for researchers to protect their inventions effectively. Participants were guided on how to write claims that are neither too broad (risking rejection) nor too narrow (limiting protection). He also highlighted frequent mistakes made by first-time inventors and researchers like disclosing the invention publicly before filing, poorly written claims etc. He recommended best practices such as maintaining an **invention disclosure notebook**, regularly consulting with IP professionals, and developing a culture of innovation and protection within institutions.

The session was interactive, with several participants raising questions about the scope of patenting in various disciplines, challenges in drafting, and the commercialization of patents. Prof. Haranath addressed all queries patiently and encouraged young researchers to cultivate awareness of IPR alongside their technical research.

In conclusion, the session significantly enriched the participants' understanding of IPR and equipped them with essential insights into the art of patent drafting. It was well-received by the audience, who appreciated Prof. Haranath's clarity, depth of knowledge, and engaging presentation style.

Session -II (12:15 PM to 01:45 PM) Lecture-13

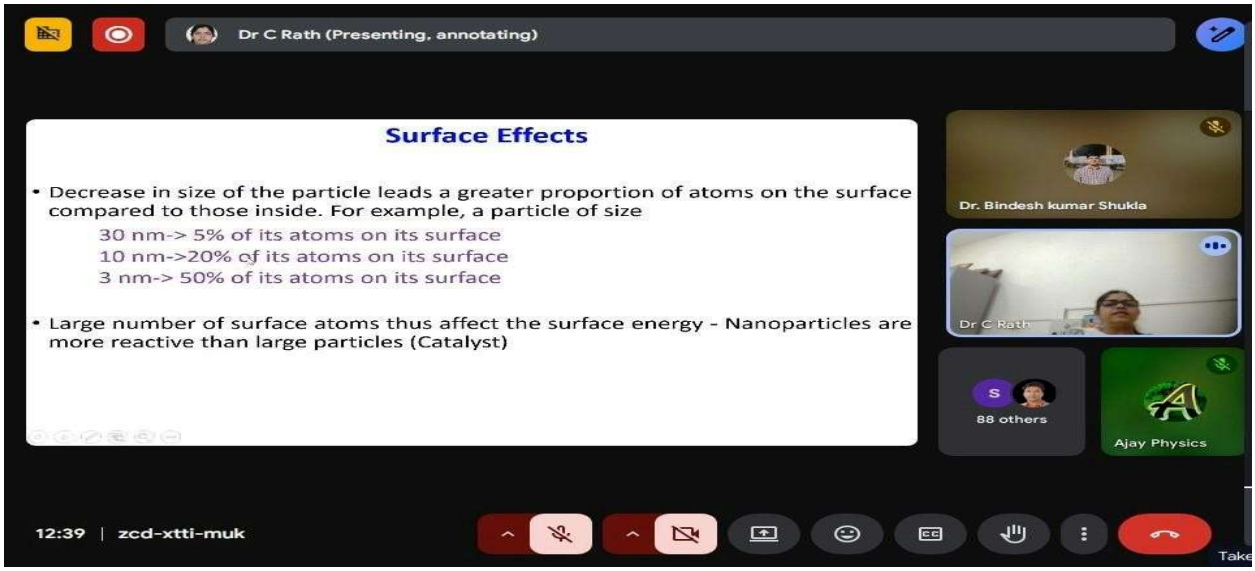
Speaker

Prof. Chandana Rath

Professor
School of Materials Science and Technology, Indian Institute of Technology (IIT) BHU, Varanasi

Title of Lecture- "Structural Phase Transition Induced Unusual Magnetic Phenomena in $Co_xMn_{3-x}O_4$ Nanoparticles"

Dr. Chandana Rath, an expert in nanomaterials and magnetism, provided an in depth lecture based on intricate role of structural phase transitions in influencing magnetic phenomena in $Co_xMn_{3-x}O_4$ nanoparticles. The session provided valuable insights into fundamental concepts in nanoscience, complex spin interactions, and experimental techniques used to study these systems. It was especially enlightening for researchers and academicians working in condensed matter physics, materials science, and nanotechnology.



Dr. Rath began by highlighting the unique properties of nanostructured materials compared to their bulk counterparts. The significance of quantum confinement—where the dimensions of a material are small enough to alter the electronic energy levels—was emphasized. These confinement effects play a critical role in determining the optical, electronic, and magnetic behavior of nanoparticles. She also commented on the role of nanoparticle to reduce surface energy by employing several phenomena like surface relaxation, surface restructuring**.** She also explained how spatial confinement of electrons in low-dimensional systems such as quantum dots leads to discrete energy levels, modifying their electronic and magnetic responses. These phenomena are particularly relevant in nanoparticles where such confinement can dramatically influence material behavior even with minimal changes in size or composition. The speaker then introduced the structure of spinel oxides particularly $Co_xMn_{3-x}O_4$. Two spinel configurations namely **Normal** (Co^{2+} in A site, Mn^{3+} in B site), and **Inverse** spinel (Mn^{3+} in A site, Co^{2+} and Mn^{3+} in B site) were discussed.

At the last, Dr. Rath highlighted the advanced techniques like **X-ray Absorption Fine Structure (XAFS), X-ray Photoelectron Spectroscopy (XPS) and Magnetometry** employed to probe structural and magnetic properties. She offered an enriching exploration of how nanoscale structural modifications in $Co_xMn_{3-x}O_4$ influence emergent magnetic properties. Her presentation bridged theoretical insights with experimental evidence, shedding light on phenomena like exchange bias and coercivity anomalies that are not typically observed in bulk material

Micro teaching Group I

Date-18/07/2025 (Friday)
Session III & IV; Time – 2:15 to 5:30 pm

Chairperson/Reporter: -

1. Dr. Ashish Wamanrao Selokar
2. Dr. Sanat Kumar Gogoi

Subject Expert
Dr. Yugal Kishor Mahipal
Assistant Professor
Pt. Ravishankar Shukla University

Microteaching is a focused training method designed to help educators improve specific teaching skills through short, peer-reviewed instructional sessions. It emphasizes structured observation, constructive feedback, and skill-based assessment, leading to noticeable improvements in classroom delivery, content clarity, time management, and student engagement. First introduced in the 1960s by Dwight W. Allen, microteaching remains a widely accepted technique for enhancing teaching effectiveness in higher education.

The Group I Microteaching session began promptly at 2:15 PM, coordinated by Dr. Ashish Selokar. A total of 24 participants presented their microteaching sessions, with each allotted five minutes to deliver a concise lesson. The presentations reflected a wide array of scientific topics, ranging from the structure of atoms and subatomic particles to the broader concepts of cosmology.

Presentations included a variety of intellectually engaging subjects such as:

- The mystery of atoms
- The flow of time
- Theory of relativity
- Photoelectric effect
- X-ray diffraction
- Entropy
- Modern scientific insights in Vedic literature
- Vector spaces
- The Michelson–Morley experiment
- Logic gates
- Emission spectra of hydrogen and sodium

The presenters were faculty members from various colleges and universities across the country, each demonstrating a strong command over their subject matter and effective communication skills. Respected Dr. Yugal Kishor Mahipal, subject expert, was present throughout the session and provided valuable feedback and observations to each presenter, focusing on content delivery, pedagogical techniques, and clarity of explanation.

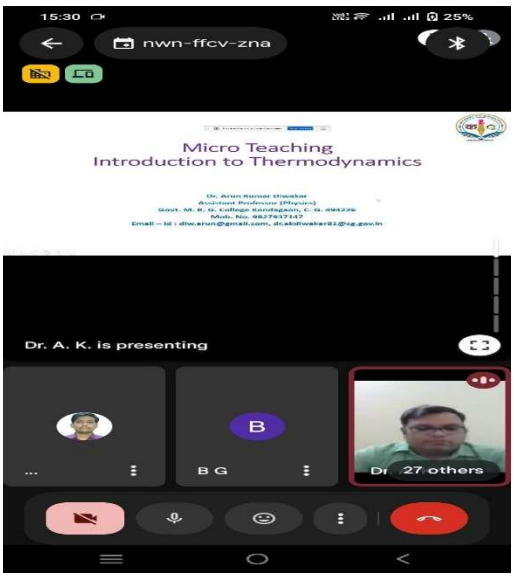
The session was well-organized, intellectually stimulating, and highly interactive. It concluded with a vote of thanks offered to the subject expert for his constructive feedback, and to all the participants for their enthusiastic and thoughtful presentations.

Micro teaching Group II

Chairperson- Dr. Mahendra Kumar
Reporter- Dr. Mrs. Priyanka Sambhaji Shinde

Subject Expert
Prof. B G Sharma
Professor, Govt. Nagarjuna PG College of Science, Raipur

The **Refresher Course in Physical Sciences**, organized by **MMTTC**, Pt. Ravishankar Shukla University, Raipur, is scheduled from **15th July 2025 to 31st July 2025**. The session commenced with a warm welcome of **Dr. Bal Gopal Sharma**, Govt. Nagarjuna P. G. College of Science Raipur. As the chairperson, **Dr. Mahendra Kumar** extended greetings to **Dr. Bal Gopal Sharma**, microteaching session expert, and participants and highlighted the significant achievements of **Dr. Bal Gopal Sharma**. The chairperson outlined the brief introduction of **Dr. Bal Gopal Sharma** including his U.G. and P.G. teaching experience, Ph.D. supervision, research projects funded by UGC, research articles published, invited talks delivered and papers presented in national and international conferences. All the participants were actively involved in the microteaching session except two (Dr. Ravinder Kumar and Dr. Neson Varghese). Different participants delivered nice, brief and informative presentation on diverse fields of Physics like-lasers, semiconductors, symmetry, SEM, photoelectric effect, thermodynamics, nanoscience, thermoelectric effect, Newton's laws of motion, etc. The session concluded with a short remark by **Dr. Bal Gopal Sharma** appreciating the initiative taken by MMTTC allowing informal encouragement and interaction among the participants and organizers.



DAY: 05 (21.07.2025)

Chairperson/Reporter: -

(1) Dr. Vineet Kumar Pandey

(2) Dr. Bal Govind

Session -I (10:30am to 12:00 noon) Lecture-14

Speaker

Dr. M. Shahid Anwar

Sr. Principal Scientist CSIR-IMMT Bhubaneshwar

Title of Lecture- "Transforming Energy with Advanced Materials and Smart Devices"

Dr. M. Shahid Anwar delivered an insightful and comprehensive lecture titled "Transforming Energy with Advanced Materials and Smart Devices."

In his talk, Dr. Anwar explored innovative techniques for energy conversion — the process of transforming energy from one form into another. He emphasized the pivotal role of advanced materials in this transformation, highlighting several key materials used in energy harvesting and conversion, including piezoelectric, thermoelectric, and triboelectric materials, as well as solid oxide fuel cells. He further explained that by strategically combining these materials, new multifunctional devices and materials can be engineered to enhance energy conversion capabilities. Dr. Anwar also addressed the growing global energy crisis, primarily driven by the high consumption of electricity and the increasing demand for energy-dependent devices. He emphasized that, although these advanced materials may not completely resolve the crisis, they offer promising pathways to mitigate it to a certain extent by improving energy efficiency and enabling alternative energy sources. One of the most notable parts of the lecture was his discussion on nanogenerators,

devices capable of harvesting energy from small-scale mechanical motions using the aforementioned materials. He described the invention of nanogenerators as one of the top ten scientific breakthroughs globally, due to their potential to revolutionize self-powered electronics. He delved deeper into the properties of polar materials, illustrating how their structure determines whether they exhibit piezoelectric or ferroelectric behavior, based on the nature and orientation of their internal polarization. Furthermore, he introduced the concept of flexoelectric crystals, which can generate electric polarization through strain gradients, particularly in non-centrosymmetric materials.

Dr. Anwar highlighted the dual nature of certain materials, noting that polymers, while possessing high piezoelectric responses, tend to have low dielectric breakdown strength, limiting their performance in high-voltage applications. A particularly innovative idea presented was the potential to harvest energy from ocean waves using self-powered generators. However, he acknowledged the primary challenge in this approach lies in the irregular and low-frequency nature of ocean wave motion, which poses difficulties in consistent energy generation. Additionally, he discussed the fabrication of lead-free polymer-ceramic composites, a more environmentally friendly alternative for energy devices. He outlined

the preparation process, which involves powder synthesis of constituent materials, forming pellets with a pelletizer, and then hot-pressing them to achieve the desired composite structure.
Dr. Anwar concluded his lecture by emphasizing the bright future of energy technologies driven by continued research and innovation. He underscored the importance of improving the efficiency, stability, and cost-effectiveness of materials and devices to make them viable for real-world applications.

Session -II (12:15 PM to 01:45 PM) Lecture-15

Speaker
Prof. Sukanta Kumar Tripathy
Professor Berhampur University

Title of Lecture- "Emerging Materials for Photovoltaic and Sensing Application"

Prof. (Dr.) Sukanta Kumar Tripathy delivered an engaging and informative lecture titled "Emerging Materials for Photovoltaic and Sensing Applications."

In his presentation, Prof. Tripathy focused on two primary areas of interest namely, Photovoltaic applications, particularly involving perovskite materials for solar cells, and, Sensing applications, emphasizing the use of nonlinear materials for low-energy detection. He began by explaining the fundamental theory and working principles of photovoltaic cells, detailing key processes such as light absorption, electron excitation, and electron-hole recombination. He then discussed the operation of single-junction solar cells, analyzing their advantages and limitations with respect to energy efficiency, material toxicity, fabrication cost, and photoconductivity. Moving forward, Prof. Tripathy explored second- generation solar cells, including CdTe and CIGS types, which often use amorphous silicon thin films. While these cells are cost-effective, they typically offer lower efficiency compared to first-generation silicon-based cells. He then introduced third-generation solar cells, categorizing them into dye-sensitized solar cells and quantum dot solar cells. Quantum dot cells, he noted, are particularly promising due to their ability to generate multiple electron-hole pairs from a single photon, significantly improving efficiency. The main focus of his lecture, however, was his research on perovskite solar cell materials with a general formula of ABX_3. These materials are especially attractive due to their low raw material and fabrication costs, mechanical flexibility, tunable band gaps, and high power conversion efficiencies, which can exceed 26%. Prof. Tripathy shared his remarkable achievement of a 31.5% photoconversion efficiency using $MASnI_3$-based perovskite solar cells integrated with chalcogenide electron transport layers (ETLs). Despite this high efficiency, he acknowledged the issue of limited stability and proposed the use of azetidinium-based perovskites as a potential solution for enhanced long-term performance.
Shifting to sensing applications, Prof. Tripathy discussed the use of nonlinear materials in temperature sensing at extremely low energies. He demonstrated how a single photon could

be employed for temperature detection via optical fibers. This method also allows for the measurement of unknown temperatures. A critical challenge in such systems is the quantum limit, which restricts sensitivity. To address this, he recommended the adoption of non- classical quantum detectors. Nonlinear crystals, due to their property of spontaneous parametric down-conversion, play a key role in this sensing method. Prof. Tripathy further illustrated the concept through real-time experimental demonstrations, using heralded single photons and actual crystal-based setups for temperature detection.

In conclusion, this lecture provided valuable insights for researchers/beginners in materials science, offering both foundational knowledge and cutting-edge developments in photovoltaic and sensing technologies. It was especially beneficial for those involved in next-generation energy solutions and quantum-enabled sensing systems.

Session -III (02:15 PM to 03:45 PM) Lecture-16

Speaker Prof. O. P. Thakur
Scientist F Physics Lan DRDO Timarpur, Delhi

Title of Lecture- "Wide Band Gap Semiconductors and Functional Ceramics for Energy Technologies".

Prof. O. P. Thakur delivered an insightful lecture titled "Wide Band Gap Semiconductors and Functional Ceramics for Energy Technologies."

In his presentation, Prof. Thakur provided a concise overview of advanced semiconductor materials and devices, with a particular focus on wide band gap semiconductors and their applications in energy-related technologies. He highlighted materials such as Gallium Nitride (GaN), Silicon Carbide (SiC), and Gallium Oxide (Ga_2O_3), which are widely used

in high-power electronics, laser diodes, and Micro-Electro-Mechanical Systems (MEMS), including components like accelerometers, RF switches, and vector hydrophones. He also showcased several devices developed at SSPL, DRDO, illustrating practical implementations of these materials in defense and industrial applications. Prof. Thakur drew attention to the environmental impact of traditional power generation, explaining that carbon dioxide (CO_2) emissions primarily stem from the burning of fossil fuels for electricity. As a potential solution, he introduced functional ceramics as key materials that could enhance energy efficiency and support sustainable energy technologies. A significant portion of the lecture was dedicated to Silicon Carbide (SiC) — its synthesis, material properties, and wide-ranging applications. SiC stands out for its low density, high hardness, excellent mechanical strength, low thermal expansion, and superior thermal and chemical stability. These attributes make it ideal for use in automotive and aerospace industries, heating elements, cement manufacturing, and other high-temperature or high-stress environments. He emphasized SiC's wide band gap, compatibility with large-area wafer technology, and its expanding market potential. SiC exhibits a high Johnson figure of merit, nearly 100% greater than that of GaAs or silicon (Si), indicating its superior performance in high-frequency and high-power devices. It can also be tailored into n-type, p-type, or semi-insulating forms, allowing for versatile applications. In the context of sensing, Prof. Thakur noted that SiC-based sensors

are capable of detecting temperature, acceleration, pressure, strain, and can also function in radiation-prone environments, making them valuable in harsh operational settings. He concluded with a discussion on SiC crystal growth technologies, particularly the production of high-quality single crystals through induction heating at temperatures around 2500°C. This crystal growth technique is considered a critical success factor for the widespread adoption of SiC in commercial and industrial technologies.
Overall, the lecture was highly beneficial for researchers working in the fields of semiconductors, energy technologies, and advanced functional materials, offering both theoretical insights and practical applications.

Session -IV (04:00 PM to 05:30 PM) Lecture-17

Speaker Dr. Arun Singh
Guru Ghasidas Central University, Raipur, Chhattisgarh

Title of Lecture- "Emerging Materials for Energy Applications"

Dr. Arun Singh delivered an engaging and informative lecture titled "Emerging Materials for Energy Applications."
In his talk, Dr. Singh explored a variety of emerging materials with significant potential in energy-related technologies. These include organic semiconductors, nanomaterials, metal oxides, composites, and nanocomposites. A major focus of his lecture was on conducting polymers, which can have their bandgap finely tuned — enabling transitions from insulating to metallic states, thereby broadening their applicability in energy devices.
Dr. Singh elaborated on various forms of nanometals, classified by dimensionality: zero-, one-, and two-dimensional nanostructures. Among these, two-dimensional (2D) materials such as graphene, transition metal dichalcogenides (MoS_2, WS_2), and hexagonal boron nitride (h-BN) were emphasized for their exceptionally high charge carrier mobility, despite their typically zero or near-zero bandgap. The combination or hybridization of these 2D materials can result in novel properties, making them highly suitable for applications in gas sensors, photonic devices, biosensors, electronic devices, and piezoelectric systems. A significant portion of the lecture focused on energy storage applications, particularly involving graphene multilayers and other 2D materials like MoS_2 and WS_2. Dr. Singh discussed the characterization techniques used to analyze these materials, such as Raman
Spectroscopy and Transmission Electron Microscopy (TEM). He also delved into polymer nanocomposites, which are created by combining a polymer matrix with nanoscale fillers. These nanocomposites can be effectively characterized using X-Ray Diffraction (XRD), and they hold promise in a range of functional applications, particularly in energy storage and conversion. Addressing the growing global energy crisis, Dr. Singh emphasized the urgent need for high-performance energy storage solutions. He introduced supercapacitors as a promising alternative to traditional batteries due to their extremely fast charge- discharge rates and long cycle life. He discussed three main types of supercapacitors:

1. Electric Double Layer Capacitors (EDLCs)
2. Hybrid supercapacitors
3. Pseudocapacitors

Dr. Singh presented schematic diagrams of these devices and elaborated on key performance parameters used to evaluate their efficiency and suitability for real-world applications.
In conclusion, the lecture provided valuable insights into the latest materials and technologies in the energy sector, especially for researchers working on advanced energy storage systems, nanotechnology, and functional materials.

DAY: 06 (22.07.2025)

Chairperson/Reporter: -

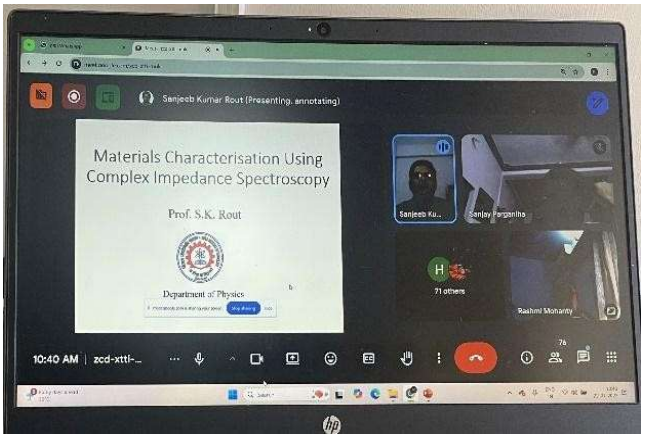
1. ***Smt. Rashmi Mohanty***
2. ***Dr. Meenal Malik***

Session -I (10:30am to 12:00 noon) Lecture-18

Speaker Dr. S K Rout
Professor
Dept. of Physics, BIT Mesra

Title of Lecture- "Impedance Spectroscopy-I"

Dr Sanjeeb Kumar Rout delivered a comprehensive lecture titled " **Impedance Spectroscopy**". In his lecture, he focused on Impedance Spectroscopy, a technique used to study the electrical properties of materials, especially in nanomaterials and ceramics. It is a more advanced and useful method than DC measurements for understanding materials. He explained the principle of Impedance Spectroscopy and defined as a frequency-dependent resistance. He also stated that benefits of using AC over DC and explained how AC allows better separation of grain, grain boundary or defects and electrode responses. He also described Working Principle, behaviour of basic circuit components like resistors, capacitors, and inductors and construction of equivalent circuits. He focused on how the response of each element changes with frequency. He described how plots like **Nyquist and Bode plots** help in interpreting results. The importance of modelling circuits with resistors and capacitors to understand how materials behave and experimental data using these plots was emphasized.



Session -II (12.15pm to 1.45 pm) Lecture-19

Title of Lecture- "Impedance Spectroscopy-II"

Dr Sanjeeb Kumar Rout presented a comprehensive lecture titled " **Impedance Spectroscopy**". In this lecture, he focused on real experiments including his Work on 'nickel-doped strontium titanate' and 'barium titanate'. He explained how grain size and
boundary resistance change with doping and **anisotropic properties** of ceramics. He also described about the directional differences in dielectric constants, non-ideal relaxations at high temperatures, multiple relaxation processes and varying activation energies, findings from his previous research conducted. Then his topic moved to different types of fuel cells, such as SOFCs and proton-conducting SOFCs. Dr. Rout explained the issues of high operating temperature, and material degradation challenges. Then detailed their laboratory's study of barium cerate based and barium zirconium-based material, noting that Cerate-based materials showed high conductivity but poor stability. Zirconate-based ones were more stable but less conductive. He explained about their developed **cobalt-free cathodes**, which are more stable and cost-effective. Dr Rout concluded his lecture provided valuable insights for researchers a reliable and non-destructive technique help to studying electrical properties of materials. It's useful in developing better electronics and clean energy devices, like **fuel cells**. The session was concluded with a question-and-answer segment.

Micro teaching Group III

Date-22/07/2025 (Friday)
Session III & IV; Time – 2:15 to 5:30 pm
Chairperson/ Reporter

1. Dr. Lini Devassy
2. Dr. S. Ranjith

Subject Expert
Prof. Dipti Jha
Professor
Dr. R.B. Government Navin Kanya Mahavidyalaya Raipur

Dr. Lini Devassy started the session by introducing the microteaching session observer, Dr. Dipti Jha, who is a Professor of Physics at Dr. R.B. Government Navin Kanya Mahavidyalaya in Raipur, Chhattisgarh. The microteaching sessions that were conducted during the refresher course were designed to improve pedagogical skills by facilitating structured, focused teaching practices. Each participant was responsible for delivering a brief lecture (5–10 minutes) on a selected topic within their field, which was followed by feedback from both peers and experts. The initial participant, Dr. Lini Devassy, initiated the lecture with the title "Nonlinear Dynamics ".

Key Objectives:

- To improve specific teaching skills (e.g., introduction, explanation, questioning, reinforcement).
- To provide a platform for peer learning and reflective teaching.
- To incorporate innovative teaching strategies and technology use.

Methodology:

- Participants were grouped and assigned time slots.
- Each session involved:
  - A brief lesson by the participant.
  - Observation and feedback by peers and course coordinators.
  - Self-assessment and reflection.
- A feedback rubric was used to assess clarity, content organization, delivery style, and student engagement.

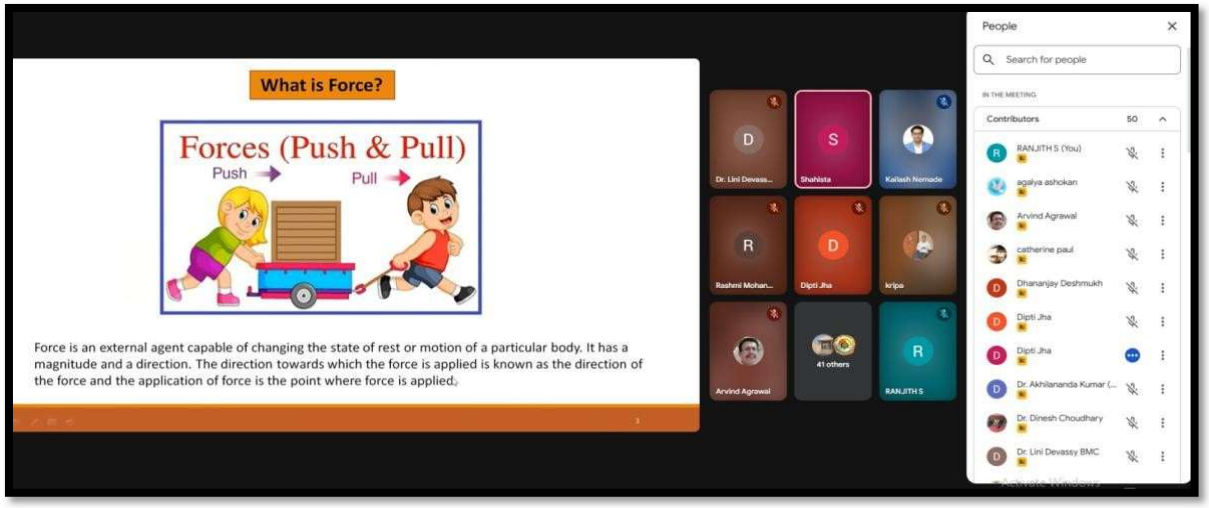
The refresher course's microteaching sessions were a valuable component, substantially contributing to professional development. It promoted a culture of reflective practice and continuous learning, providing educators with refined teaching methodologies that are in accordance with the requirements of contemporary classrooms.

Dr. Dipti Jha, the observer, provides feedback during the session's conclusion. She provided a comprehensive summary of the observations that were made during the session.

Observations:

- **Strengths:** Clear communication, good content knowledge, effective use of examples.
- **Areas for Improvement:** Time management, blackboard/visual aid usage, interaction with learners, use of technology tools.
- **Innovative Practices Noted:** Use of simulations, interactive quizzes, storytelling techniques.

Finally, the chairperson and reporter Dr. Lini Devassy and Dr. S. Ranjith thanked coordinators, observers and the participants for the successful completion of today's microteaching session.



Micro teaching Group IV

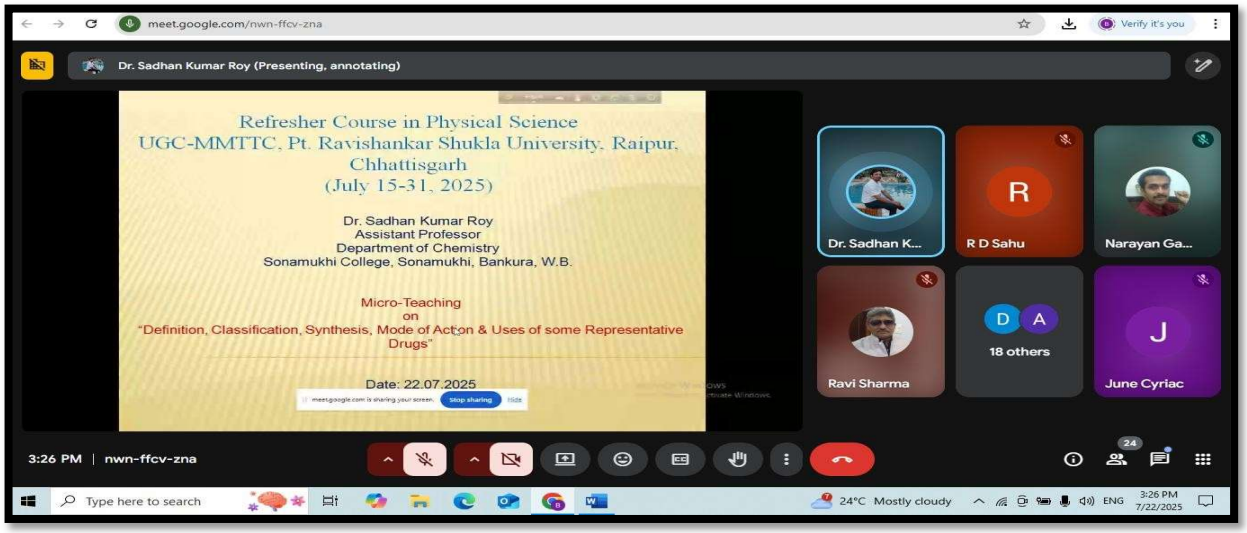
Date-22/07/2025 (Friday)
Session III & IV; Time – 2:15 to 5:30 pm

Chairperson/Reporter: -

(1) Dr. Sadhan Kumar Roy
(2) Dr. June Cyriac

Subject Expert
Dr. Ravi Sharma
Assistant Professor, Govt. SGS Girls College,
Devendra Nagar, Raipur

The second session on Microteaching of the Refresher Course in Physical Sciences, organized by MMTTC, Pt. Ravishankar Shukla University, Raipur, was held on 22nd July 2025. The session commenced with a warm welcome by Dr. Sadhan Kumar Roy, Assistant Professor, Sonamukhi College, Sonamukhi. who was the chairperson of the session. He introduced the subject expert Dr. Ravi Sharma, Assistant Professor and HoD, Govt. SGS Girls College, Devendra Nagar, Raipur. A total of 23 participants presented their microteaching in various topics related to Physics and Chemistry. Dr. Ravi Sharma appreciated all the candidates for their presentation. He stressed the importance of sticking to time limit, understanding the audience, need of live examples, making the topic simpler and asking questions based on the topic. The session came to an end by the report presentation by Dr. June Cyriac, Assistant Professor, Sacred Heart College, Kochi, Kerala. Some photos of the session and list of participants with their topics are also attached.



DAY: 07 (23.07.2025)

Chairperson/Reporter: -

1. Dr. M. Hemamalini
2. Mrs. Arti Sharma

Session- I (10.30am-12.00 noon) Lecture-20

Speaker

Prof. Pawan Kumar
Professor
Dept. Of Physics & Astronomy, NIT Rourkela

Title of the Session I: Lead free functional materials for energy storage applications

Professor Pawan Kumar's talk provided a comprehensive overview of lead-free functional materials for energy storage applications, highlighting the critical need for sustainable and efficient energy solutions in today's world. He began by discussing the diverse landscape of energy storage applications, ranging from

portable electronics to grid-scale systems, and categorized the materials involved into ceramics, polymers, and composites. The emphasis on lead-free materials underscored the drive for environmentally benign alternatives to traditional lead-based components, necessitating significant research and development.

A key focus of his presentation was the advanced synthesis technique of microwave processing for ceramics. This method offers distinct advantages over conventional heating, including faster heating rates, improved energy efficiency, and the ability to achieve more refined and uniform microstructures in ceramic materials. He specifically detailed the application of this technique to CCTO (Calcium Copper Titanate) ceramics, known for their exceptionally high dielectric constant, and discussed a new processing route developed for their synthesis. The characterization of these materials was further elaborated through X-ray diffraction (XRD) studies, a fundamental technique for confirming crystalline structure, phase purity, and understanding the impact of processing on material properties.

Furthermore, Professor Kumar presented insights into epoxy/CCTNAO and epoxy/CCNAO composites. These composite materials are designed to leverage the high dielectric properties of modified CCTO ceramic fillers while benefiting from the mechanical flexibility and processability of an epoxy matrix. The discussion covered both their dielectric properties (crucial for energy storage capacity) and their mechanical properties (important for structural integrity and device longevity). Finally, he delved into the strategic approach of tailoring ferroelectric and breakdown behavior in ceramics through controlled MgO addition. This technique is vital for enhancing the energy storage density and reliability of ceramic materials by improving their ability to withstand higher electric fields and exhibit desirable ferroelectric responses. The talk collectively showcased a multi-faceted approach to developing next-generation lead-free materials for advanced energy storage.

Session- II (12:15pm-1:45pm) Lecture-21

Speaker

Prof. Dillip Satapathy.
(Professor)
Dept. Of Physics, IIT Madras

Title: SILK FIBROIN BASED VAPOUR RESPONSIVE SOFT ACTUATORS

This report summarizes the insightful presentation by Professor Dilip, who shared invaluable insights and cutting-edge research on the fascinating and highly relevant topic of soft actuators. His dedication to advancing the field of soft robotics and smart materials is truly inspiring.

Professor Dilip began by elucidating the need for soft actuators. Unlike traditional rigid robots, soft actuators offer inherent compliance, adaptability, and safety, making them ideal for delicate manipulation, human-robot interaction, and operations in unstructured environments. He emphasized the growing importance of material-based intelligence in these systems, where the material itself possesses functionalities that contribute to the actuator's performance. Furthermore, the discussion highlighted the drive towards integrated functionality, where sensing and actuation capabilities are seamlessly combined within the same material or structure.

Professor Dilip addressed the key challenges faced in the development of soft actuators:

Durability and Fatigue Resistance: Ensuring the long-term operational integrity of soft materials under

repetitive stress remains a significant hurdle. Integration of Sensing and Actuation: Developing methods to embed robust sensing capabilities directly within the soft actuator without compromising its performance is crucial. Scalability and Miniaturization: Scaling down soft actuators for micro-robotics or medical applications, while maintaining their efficiency and control, presents engineering complexities. Precise Control of Speed and Direction: Achieving accurate and responsive control over the movement and orientation of soft actuators is vital for practical applications.

Silk-Based Biopolymers

Professor Dilip presented an in-depth exploration of silk-based biopolymer actuators. He delved into the fabrication method of these materials and elaborated on the intricate microstructure of silk, explaining how its hierarchical organization contributes to its unique mechanical properties.

A particularly interesting aspect discussed was the effect of water annealing technique on silk fabrication. Professor Dilip showed compelling evidence of how this technique, applied before and after the fabrication process, significantly influences the material's properties and subsequent actuation performance.

Session- III (2:15pm-3:45pm) Lecture-22

Speaker

Dr. Pramoda Nayak
Associate Professor
Dept. of Physics, Jain University, Bangalore

Title: Synthesis of 2D Materials and Their Heterostructures

This report summarizes the key topics covered in Prof. Nayak's two-part presentation, which provided invaluable insights into the fascinating and highly relevant fields of 2D materials and their applications in blue energy harvesting.

The first session, titled "Synthesis of 2D Materials and Their Heterostructures," delved into the fundamental aspects of nanomaterials and the specifics of two-dimensional (2D) materials. Prof. Nayak began by emphasizing that size matters in the nanoscale realm, covering the classification of nanomaterials and various types of confinement inherent to these materials. The discussion then transitioned to the necessity of 2D materials, highlighting their unique properties. An atlas of two-dimensional materials was presented, along with a comprehensive analysis of their pros and cons.

A significant portion of the session was dedicated to van der Waals (vdW) materials and their potential technological applications. Prof. Nayak detailed the preparation of graphene vdW heterostructures (HSS) and their relevance to blue energy. The presentation then moved into the synthesis of 2D materials, comparing top-down and bottom-up approaches. Specific synthesis methods discussed included the mechanical exfoliation method and chemical vapor deposition (CVD), with a comparison to physical vapor deposition.

Prof. Nayak elaborated on the growth of graphene on metal substrates using CVD and the characterization of graphene through Raman spectra. The synthesis of transition metal dichalcogenides (TMDs) using CVD and low-pressure CVD (LPCVD) was also covered, with a specific example of the growth of atomically thin WSe_2. The concept of twisted bilayer WSe_2 was introduced, along with methods to control the twist angle.

The discussion then expanded to heterostructures, specifically lateral heterostructures, and the general synthesis of van der Waals heterostructures. A captivating segment focused on twistronics and its role in generating diverse optical properties. Prof. Nayak also explored light-matter interaction in TMDs, the phenomenon of direct to indirect band gap transition, and higher-order excitation. The intriguing concept of the magic angle of graphene was presented, followed by insights from second harmonic generation measurements.

Session- IV (4:00pm-5:30pm) Lecture-23

Speaker

Dr. Pramoda Nayak
Associate Professor
Dept. of Physics, Jain University, Bangalore

Title: Blue Energy Harvesting Using 2D Membranes

The second session, "Blue Energy Harvesting Using 2D Membranes," provided a deep dive into the promising field of blue energy. Prof. Nayak began by outlining different types of energy sources before focusing on what blue energy is, specifically salinity gradient energy and its reliance on membrane-based technology. Key to blue energy harvesting is the concept of a water-selective membrane and the electrical double layer. Prof. Nayak discussed the use of conventional membranes for blue energy and then transitioned to the advantages of 2D membranes in this application. The mode of ion transport within these membranes was explained, including a detailed discussion of the Nernst-Planck equation.

The challenges associated with ion transport measurements were highlighted, along with various experimental setups like diffusion cell design and the role of nanoporous membranes. The presentation also touched upon non-linear ion transport and the utility of numerical simulation using COMSOL. Prof. Nayak addressed future challenges in blue energy harvesting.

A practical example of blue energy harvesting using 2D MoS_2 was presented. This included details on its chemical vapor deposition growth, micropore fabrication using a focused ion beam, and nanopore creation by transmission electron microscopy (TEM). The session concluded with a discussion on osmotic energy conversion.

DAY: 08 (25.07.2025)

Chairperson: Mr. Vinod Ankush Rode
Reporter: Dr. Riju K Thomas

Session- I (10:30am-12 noon) Lecture-25

Speaker

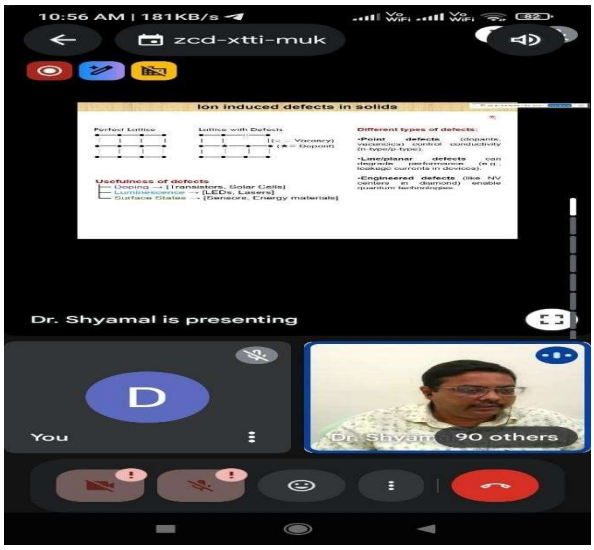
Prof. Shyamal Chatterjee,
Professor
Department of Physics, IIT Bhubaneswar

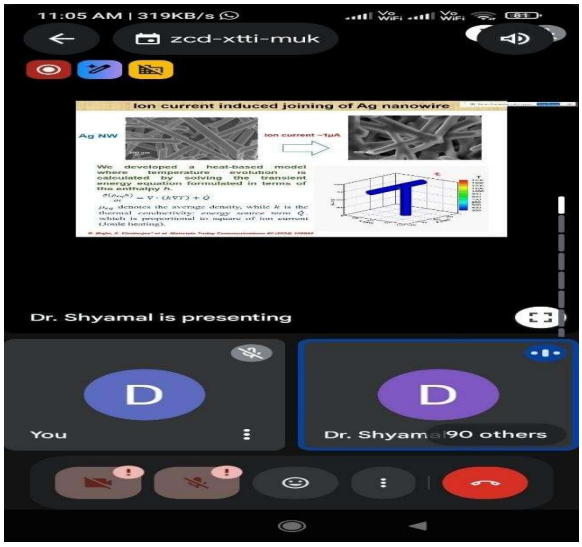
Title of Lecture- "Defect-Engineered Nanostructures for Energy Applications"

Today's session with Professor Shyamal Chatterjee from IIT Bhubaneswar was a profound and inspiring dive into the world of materials science. In his lecture, "Defect-Engineered Nanostructures for Energy Applications," he masterfully demonstrated how imperfections, when precisely controlled, can be the key to unlocking extraordinary properties in materials for energy, electronics, and beyond. The central theme of Professor Chatterjee's work, conducted at the impressive indigenous ion beam facilities at IIT Bhubaneswar, is the powerful technique of ion-solid interaction. He explained this not as a process of damaging materials, but as a form of atomic-level sculpting. By bombarding nanomaterials with energetic ions, this team can intentionally introduce and control "defects"—such as atomic vacancies or structural modifications—to fundamentally alter and enhance a material's behavior.

Professor Chatterjee presented several compelling applications from his lab's extensive research portfolio, showcasing the immense potential of this technique. One of the most striking examples was nano-joining. Using an ion beam as a nanoscale welding torch, this team successfully fused disparate silver and copper nanowires into robust, three-dimensional networks. The results were visually stunning and electrically transformative, showing a dramatic decrease in resistance from kilo-ohms to milli ohms. This breakthrough paves the way for building complex, highly conductive nano-electronic circuits from the bottom up.

Another fascinating application was the ability to control surface wettability, drawing inspiration from nature's superhydrophobic surfaces like the lotus leaf. The lecture detailed a dual-action approach on $SrMnO_3$ nanowires. At low ion energies, the beam creates chemical defects (oxygen vacancies) that inherently repel water. At higher energies, it physically welds the nanowires into a porous structure that traps air, forcing water to bead up and roll off. This capability is critical for protecting sensitive and high- performing energy materials, such as perovskites used in solar cells, from debilitating moisture damage. The culmination of this work was its direct application to energy storage, specifically in supercapacitors. Professor Chatterjee showed how ion-beam treatment of titanate nanotubes creates a synergistic effect. The beam simultaneously nano-welds the nanotubes for enhanced structural stability and electrical conductivity while creating oxygen vacancies that act as new sites for charge storage. This dual benefit led to a remarkable increase in the material's specific capacitance and endowed it with excellent long-term cycling stability, a crucial attribute for any real-world energy storage device.





Session- II (12:15pm -1:45 pm) Lecture-26

Speaker

Prof. Professor Anshuman Dalvi,
Professor
Department of Physics, BITS Pilani

Title of Lecture- Towards developing 'liquid free' next generation energy storage devices: Application to EVs, Indian context

Professor Anshuman Dalvi's lecture on the future of energy storage was a compelling exploration of the science and strategy that will power the next generation of Electric Vehicles (EVs). The session, titled "Towards developing 'liquid free' next generation energy storage devices," provided a clear roadmap from current technologies to the innovations necessary for India to become a self-reliant leader in the field. Professor Dalvi began by establishing a brilliant core analogy: a battery is a marathon runner, providing long-range energy, while a supercapacitor is a sprinter, delivering short, powerful bursts for acceleration. While today's EVs are dominated by the Nobel-winning Lithium-ion (Li-ion) battery, its reliance on a flammable liquid electrolyte presents safety risks and its power delivery is limited. The future, he argued, lies in hybrid systems that combine the strengths of both.

The heart of the presentation focused on the transition to "liquid-free" or all-solid-state batteries. By replacing the liquid electrolyte with a solid, ion-conducting material, these devices promise to be safer, longer-lasting, and more energy-dense. However, a critical hurdle has been the poor physical contact at the solid-electrode and solid-electrolyte interface, which stifles performance. Here, Professor Dalvi unveiled a breakthrough from his own research group: the creation of a "microgel layer." This innovative technique uses a gel-like interface to bridge the gap between the two solids, dramatically improving ion flow and unlocking the potential of solid-state technology. The final, and perhaps most crucial, part of the lecture addressed the Indian context. Professor Dalvi presented stark data showing the world's lithium reserves are concentrated outside India, creating a significant strategic vulnerability as the nation's EV market grows. The solution, he passionately argued, is a strategic pivot to Sodium-ion (Na-ion) batteries. Unlike lithium, the raw materials for Na-ion technology—sodium, carbon, and iron—are abundantly available in India. This is not a distant dream but an emerging industrial reality, exemplified by Reliance Industries' recent acquisition of sodium-ion firm Faradion. Professor Dalvi's message was unequivocal: instead of competing in a crowded lithium market, India has a golden opportunity to build its own ecosystem around sodium.
In conclusion, the lecture was a powerful call to action. It highlighted that the future of EV technology hinges on interdisciplinary breakthroughs in solid-state physics and chemistry. For India, the path to energy security and global leadership in this domain lies in championing alternative technologies like sodium-ion, leveraging our domestic resources to power a truly indigenous EV revolution.

Seminar Group I

Date-25/07/2025
Session III & IV; Time – 2:15 to 5:30 pm

Chairperson/Reporter: -

(1) Dr. Bindesh kumar Shukla
(2) Dr. Sanjay Parganiha

Subject Expert
Dr. H. S. Tewari
Professor, Guru Ghasidas Central University, Bilaspur

Dr. Bindesh kumar Shukla welcomed all participants and Dr. H. S. Tewari, as judge in the session. He highlighted Dr. Tewari's 30 years of teaching experience, expertise in material sciences, extensive publications, and guidance of research scholars. Total 25 participants has to give presentation in this session, out of which 22 participant gave presentation and 3 participants are absent. The participants absent are Dr. Prabhavati S Mandalageri, Dr. Anil Aarya and Mr. Devidas Irbaji Halge. Other than these Dr. Meghana Kumawat and Dr. Manju Tiwari gave their Micro-teaching Presentation. At the end of session Dr. Sanjay Parganiha gave vote of thanks to honorable Judge of the session Dr. H S Tewari and participants on behalf of MMTTC Pt. Ravishankar Shukla university, Raipur.

Seminar Group II

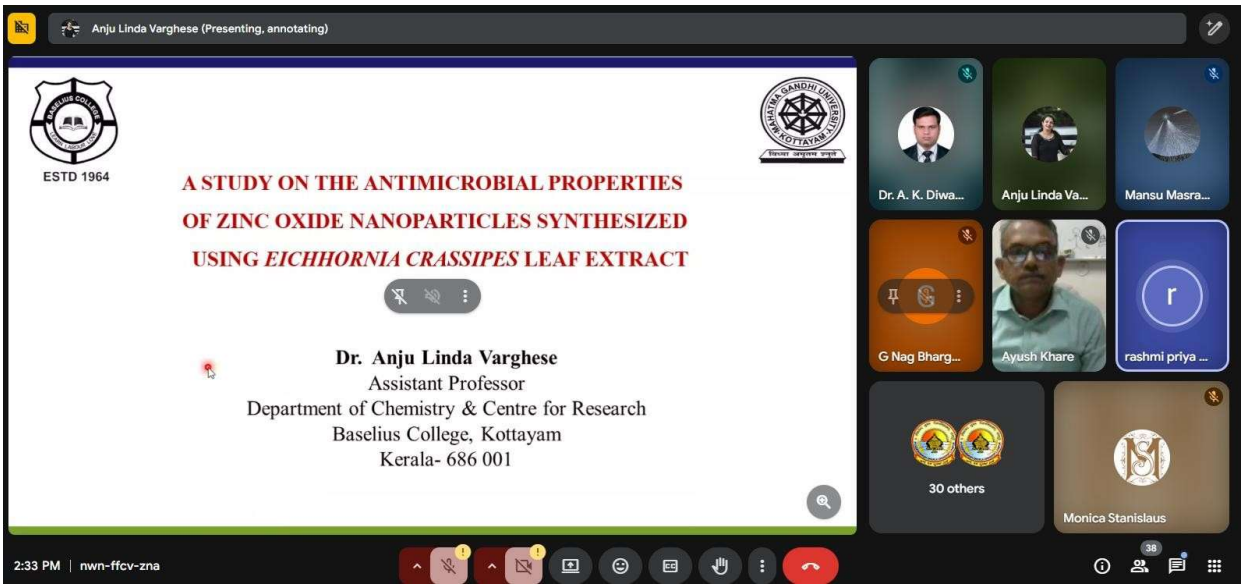
Date-25/07/2025
Session III & IV; Time – 2:15 to 5:30 pm

Chairperson/Reporter: -

(1) Dr. A K Diwakar
(2) Dr. Monica S

Resource Person
Prof. Ayush Khare
Department of Physics, NIT Raipur

Session overview: The session aims to present seminar topics by the candidates. The candidates chose their own topics for the seminar. A total of 25 participants were included to present their seminar topics. List of candidates for the presentation is given below. The session is guided by the Resource person Prof. Ayush Khare, Department of Physics, NIT Raipur. Candidates present topics such as Nanoparticles synthesized using Eichhornia crasshipes leaf extract, Introduction to remote sensing, Technology to improve teaching learning Efficiency etc. The session was very interesting. The Reporter presented a vote of thanks to Prof. Ayush Khare and concluded the session.



DAY: 09 (28.07.2025)

Chairperson/Reporter: -

1. Dr. Gaurav Saxena
2. Mrs. Shahista

Session -I (10:30am to 12:00 noon)

Speaker

Dr. Pawan Kumar

Assistant Professor Dept. of Physics,
Mahatma Gandhi Central University, Motihari

Title of lecture- "Supercapacitor as an energy storage device"

In today's session, Dr. Pawan Kumar delivered an insightful lecture on **supercapacitors** as advanced **energy storage devices** relevant to modern energy challenges. He began by discussing various energy storage devices, their types, and a detailed comparison between **batteries, conventional capacitors, and supercapacitors**. He emphasized that **efficient energy storage is the backbone of a sustainable future**. Dr. Kumar explained the evolution of supercapacitors, starting from wax-impregnated paper dielectric capacitors with foil electrodes to advanced **diesel-electric drive systems** incorporating supercapacitors. He briefly introduced the **Ragone plots**, which compare different energy storage devices in terms of energy and power density. He also highlighted the wide range of **applications of supercapacitors**, including their use in **microgrids, wind power systems, distribution automation, communication networks, transportation systems**, and **hybrid energy storage**.

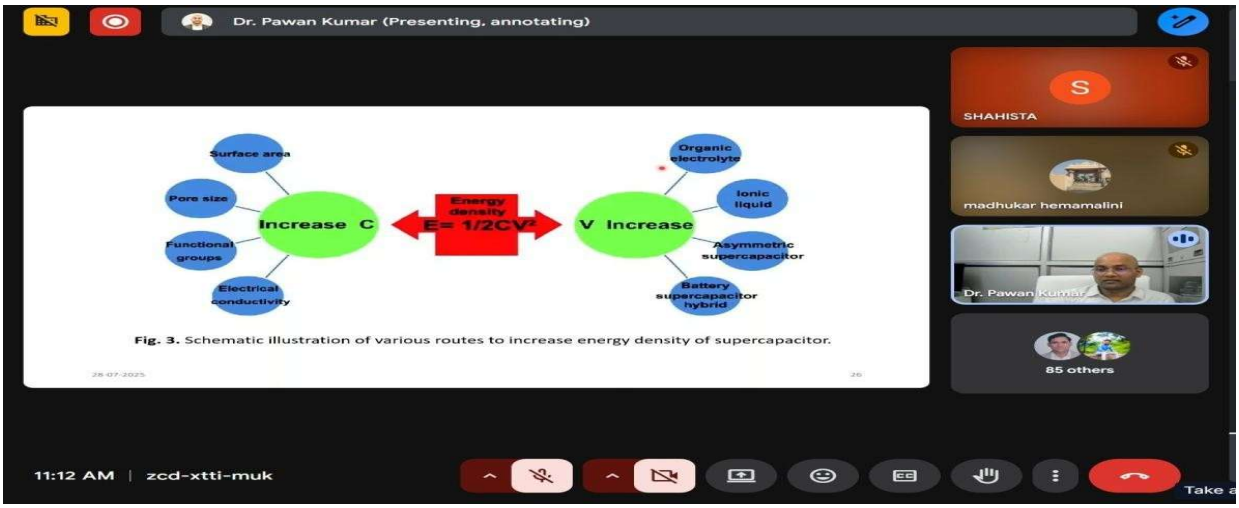
Further, he elaborated on the **charge storage mechanisms** in batteries, capacitors, and supercapacitors. He discussed the **types of supercapacitors** and their working principles, with detailed explanations of the **electric double layer (EDL)** through models like the **Helmholtz model**, **Gouy–Chapman model**, and **Gouy–Chapman–Stern model**.

The lecture also covered **Electrochemical Double Layer Capacitors (EDLCs)**, **pseudocapacitors**, and

hybrid capacitors, along with the **role of nanoscience** in improving supercapacitor performance. Dr. Kumar outlined the key factors that influence performance and various strategies to **enhance the energy density** of supercapacitors.

He presented a **comparison of the electrochemical behavior** of typical batteries and supercapacitors and explained the **electrochemical profiles** of EDLCs and hybrid capacitors. He introduced important characterization techniques such as **Galvanostatic Charge–Discharge (GCD)** and **Electrochemical Impedance Spectroscopy (EIS)**.

Dr. Kumar also provided a brief overview of **synthesis strategies for nanomaterials** used in supercapacitors and discussed **criteria for material selection**. Finally, he addressed the question of why **La-based perovskite oxides (ABO_3)** are used for supercapacitor electrodes and explained strategies to enhance the performance of these electrodes.



Session -II (12:15am to 1:45 noon)

Speaker

Prof. N L Singh Professor
University of Vadodara

Title of the lecture- Impact of Ion Beam Irradiation on Material Modification

In today's session, **Dr. N.L Singh** discussed the **interaction of ion beams with polymers** and the **effect of swift heavy ion irradiation on polymer nanocomposites**. He also explained the **development of novel host materials for radioactive waste immobilization**.

The lecture began with an explanation of **non-ionizing and ionizing radiation**, followed by the **basics of ion beam irradiation**, focusing on **nuclear and electronic energy loss** and their consequences. He introduced the concept of **accelerators in India**, their significance, and the concept of **Particle Nano Ampere (PNA)**, including how to calculate the time required to achieve a given **fluence**.

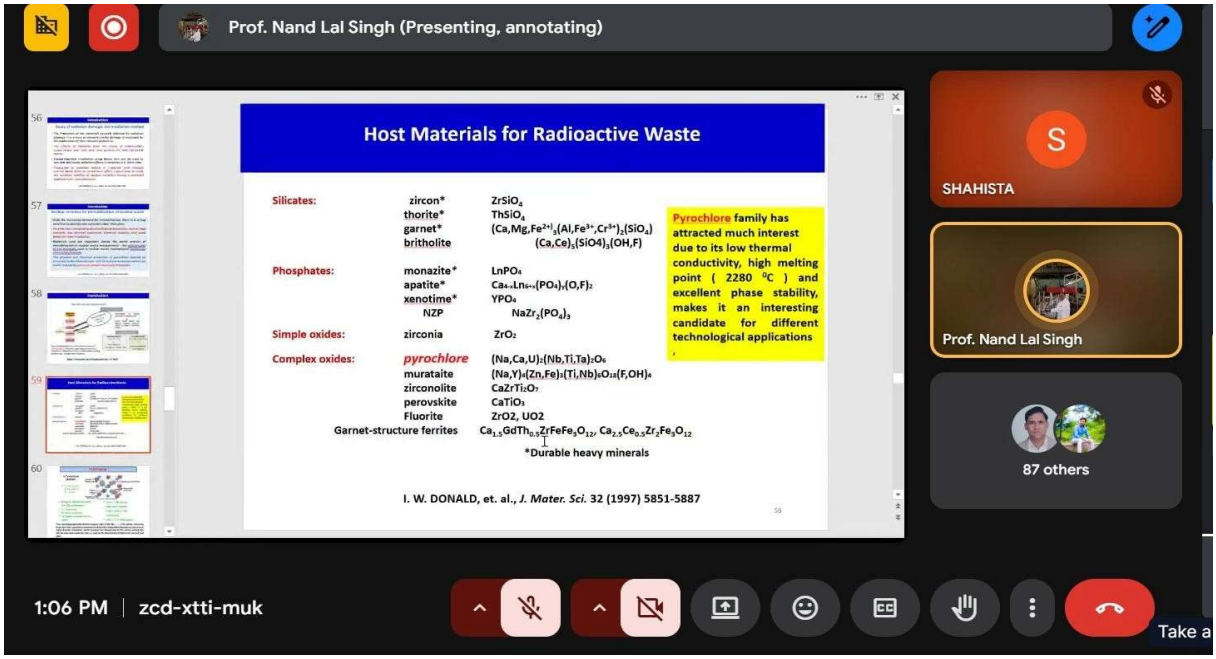
Dr. Singh then discussed **polymers and their classification** into **thermoplastics, thermosets, and elastomers**. He explained the **band gap energy of PVC** and presented the **optical absorption plots of**

PET irradiated at four different fluences. The lecture also covered **FT-IR spectral studies** as a method of analyzing polymer behavior post-irradiation.

A **brief introduction to composites** was provided, emphasizing the **importance of polymer composites**, their classification, and their **optical absorption spectra**. He highlighted the **significance of polymer composites** in modern technology, particularly their application in **sensors**.

One key topic discussed was **EMI (Electromagnetic Interference) shielding**, including its **mechanism based on reflection, absorption, and multiple reflections**. Dr. Singh also introduced **ferromagnetic nanoparticles** and elaborated on their **applications** in various fields.

Toward the end of the session, he addressed issues related to **nuclear waste management** and introduced **pyrochlore materials**, along with their **phase transitions**. Finally, he discussed the **synthesis and irradiation process of $La_2Zr_2O_7$**, a promising material in the context of nuclear applications.



Seminar Group III

Date-28/07/2025
Session III & IV; Time – 2:15 to 5:30 pm

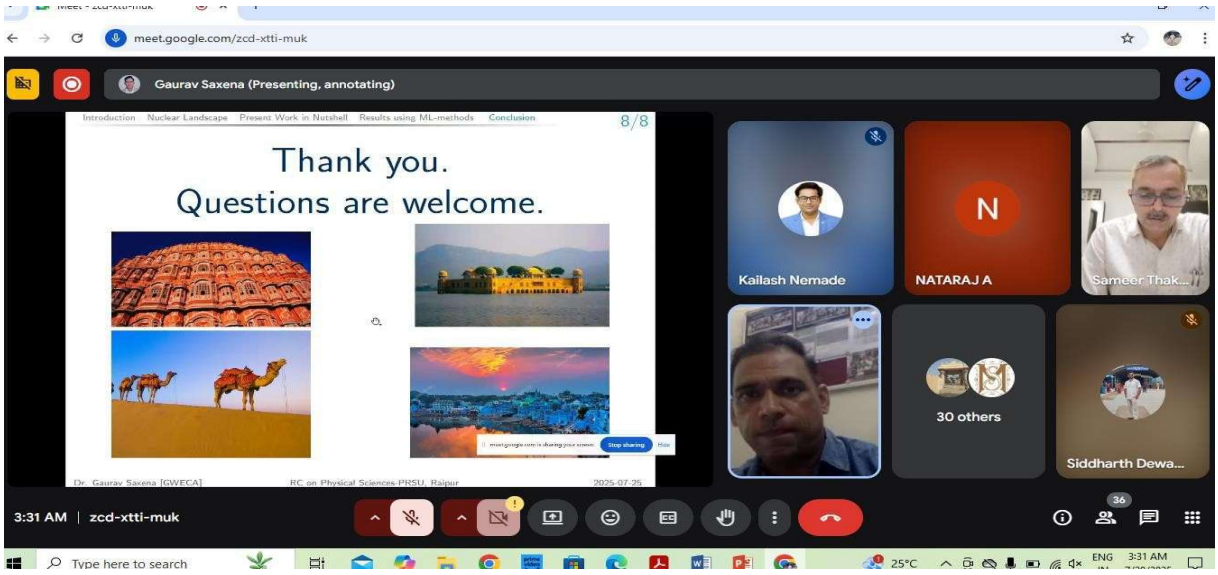
Chairperson/Reporter: -

(1) Dr. A. Nataraj

Resource Person
Prof. Sameer Thaker
Principal,
Naveen Govt. College, Bhimbhouri Bemetara

As part of the reference course in physical science organized by MMTTC – Pt. Ravishankar Shukla university, Raipur (C.G.) a seminar session (Group III) was successfully conducted under the supervision

and observation of Prof. Sameer Thakar, Principal, Naveen Govt. College Bhimbhouri Bemetara (CG). The session aimed to enhance scientific communication skills, encourage research engagement and promote collaborative academic interaction among participants. There are a total of 25 participates in the Group III Seminar Session, out of which only 22 participants delivered presentations on diverse and contemporary topics in physics, covering areas such as BE condensation, astrophysics, DFT technique, molecular docking study, theory of relativity, astrophysics, FTIR & Raman Spectra analysis, Nano-particle physics, Quantum Mechanics, Electronics, Superconductivity, Material Science, Machine Learning and Energy. Each presentation was evaluated and followed by a question-answer and feedback session conducted by Prof. Sameer Thakar sir, who provided valuable insights and constructive suggestions to enrich the participants' understanding and improve their research approaches. The seminar created a platform for vibrant academic discussion and critical thinking, contributing meaningfully to the participants' research journey. The seminar session was an intellectually stimulating and academically fruitful event. It provided participants with an opportunity to express their research ideas, receive expert feedback and engage in scholarly discussions. The collaborative environment significantly contributed to enhancing the participants' research aptitude and confidence, fulfilling the core objectives of the Reference Course.



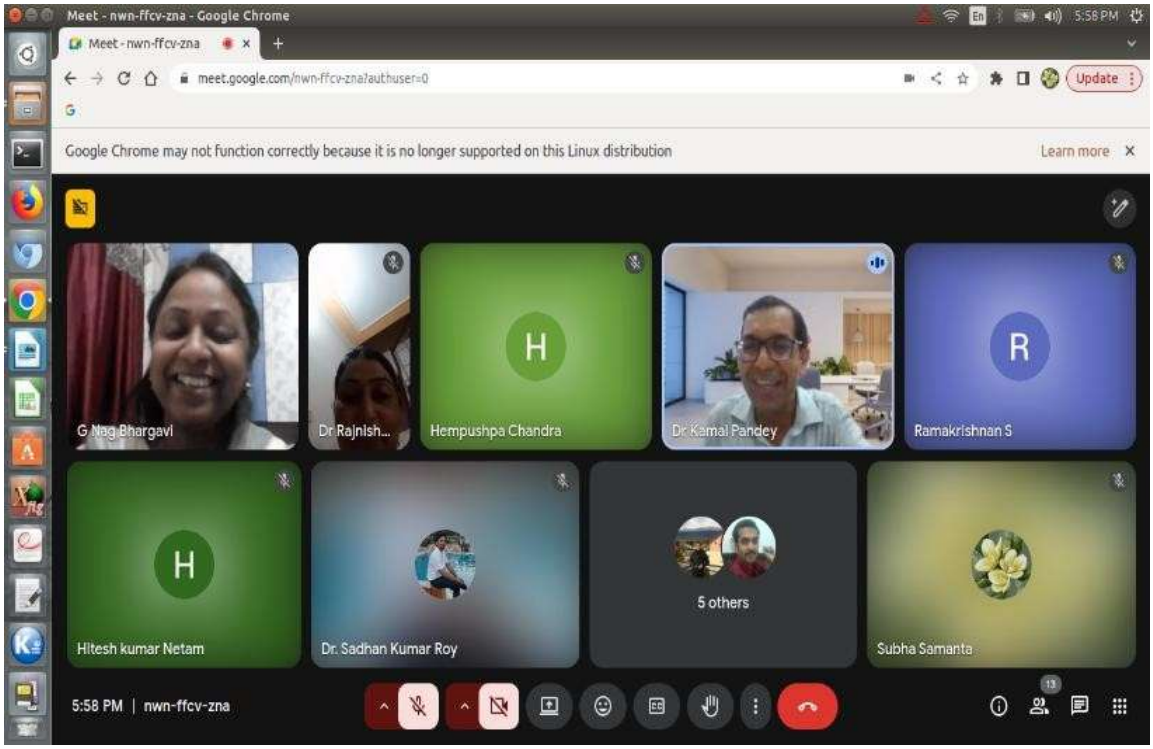
Seminar Group IV

Date-28/07/2025
Session III & IV; Time – 2:15 to 5:30 pm
Chairperson/Reporter: -

(1) Dr. Rajnish Saini
(2) Dr. Subha Samanta

Resource Person
Dr. Kamal pandey
Associate Professor
Sri Jai Narain Mishra PG College, Charbagh, Lucknow

The session has been chaired by Dr. Rajnish Saini from Doaba College, Jalandhar and Dr. Kamal Kumar Pandey, Associate Professor of Sri Jai Narain Mishra PG College, Charbagh, Lucknow, was the subject expert for this session. In this session, 31 participants were supposed to present their research works. Among them, 26 participants from diverse research fields have presented their works. The session ended with the opinion from the subject expert Dr Kamal Kumar Pandey. He expressed his views on the various works presented by the participants and expressed his amazement on the presence of participants from so many states in India.



Day: 10 (29.07.2025)
Chairperson/Reporter: -

1. Dr. Nitin Chandra, Central University of South Bihar
2. Dr. Nirbhay Kumar Behera, Central University of Tamil Nadu

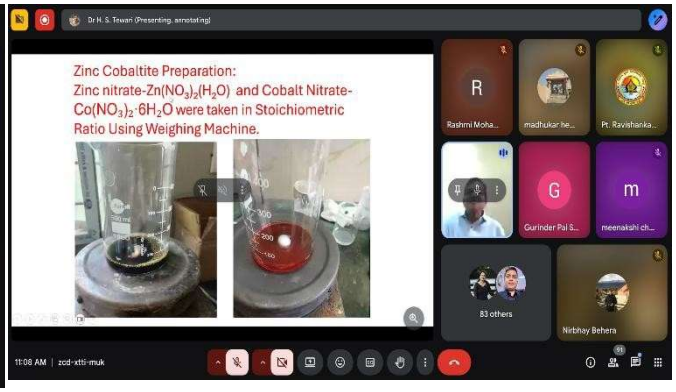
Session -I (10:30am to 12:00 noon) Lecture 29

Speaker

Prof. H S Tiwari
Professor
Dept. of Pure and Applied Physics,
Guru Ghasidas University, Bilaspur

Title of the lecture: Emerging materials for energy

In this session, Prof. H. S. Tiwari's talk on "Emerging Materials for Energy" explored advancements in materials science for enhancing energy storage, conversion, and efficiency. He highlighted nanomaterials like graphene, metal oxides, perovskites, and spinels for applications in photovoltaics, thermoelectric, and supercapacitors. Key energy storage devices—batteries, fuel cells, and supercapacitors—were discussed as electrochemical systems relying on thermodynamics and kinetics. Various supercapacitors like: electric double-layer capacitors (EDLCs), pseudo capacitors, and hybrid capacitors, with performance tied to electrode properties like surface area and conductivity were also discussed. Prof. Tiwari emphasized material characterization techniques, including cyclic voltammetry (CV), electrochemical impedance spectroscopy, and galvanometric charge-discharge, which assess capacitance, energy, and stability. He focused on perovskites and zinc cobaltite for supercapacitors, noting their structural and electrochemical advantages. A sustainable "green combustion method" using palas flower extract was described for synthesizing zinc cobaltite and lanthanum-doped zinc ferrite, characterized via X-ray diffraction (XRD) and other methods. These materials showed enhanced electrochemical performance, with high specific capacitance and stability, suitable for next-generation supercapacitors. Prof. Tiwari concluded that auto-conversion synthesis produced pure zinc ferrite without secondary phases, advancing sustainable energy solutions amid global energy challenges. Two images of the Google Meet presentation are shown below.



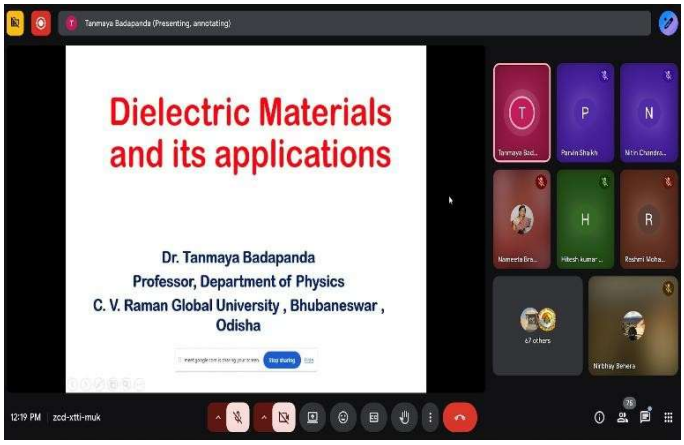
Session -II (12:15pm to 1:45 pm) Lecture 30

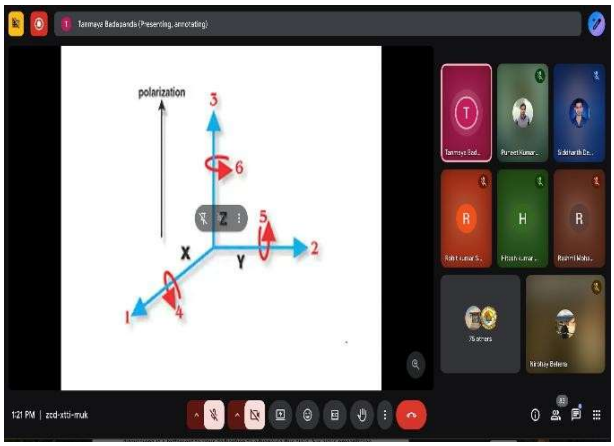
Speaker

Prof. Tanmaya Badapanda
Professor
Dept. of Physics,
C V Raman Global University, Bhubaneswar

Title of lectures: Dielectric materials and its applications -I

In the morning session, Prof. Tanmaya Badapanda covered the theoretical aspect of his work. Prof. Badapanda's presentation focused on the classification and properties of crystallographic materials, particularly dielectrics and ferroelectrics, for energy storage and piezoelectric applications. They categorized 32 crystal groups into 11 centric and 21 non-centric, with 20 being piezoelectric and 10 pyroelectric. Dielectrics, distinct from typical insulators, generate dipoles to enhance capacitance in capacitors by aligning charges with an electric field. Prof. Badapanda explained dielectric constant determination via capacitance, influenced by frequency and temperature, and polarization, defined as dipole moment per unit volume, linked to atomic polarizability and susceptibility. He then derived the expressions for dielectric behavior, incorporating temperature-dependent constants like lambda and theta, and discussed modifications for materials with inconsistent dielectric constants, introducing diffusivity (gamma). Prof. Badapanda explored ferroelectric materials, which exhibit spontaneous polarization reversible by an electric field, forming hysteresis loops with key parameters: saturation polarization (PS), coercive field (EC), and remnant polarization (PR). Ferroelectrics were classified into normal and relaxor types, with relaxors showing frequency-dependent dielectric constants and polar nano-regions defined by burn and freezing temperatures. Energy storage was discussed, covering solid oxide capacitors, supercapacitors, and dielectric capacitors, with calculations for specific energy, power density, and energy loss density derived from P-E loops. Prof. Badapanda also detailed the piezoelectric effect—direct (mechanical stress to charge) for sensors and inverse (electric field to strain) for actuators—highlighting coefficients like D33 and D15, and the electromechanical coupling factor as critical for material suitability in industrial applications like robotics. Here are two screenshots from Google Meet shown.





Session -II (2:15pm to 3:45 pm) Lecture 31

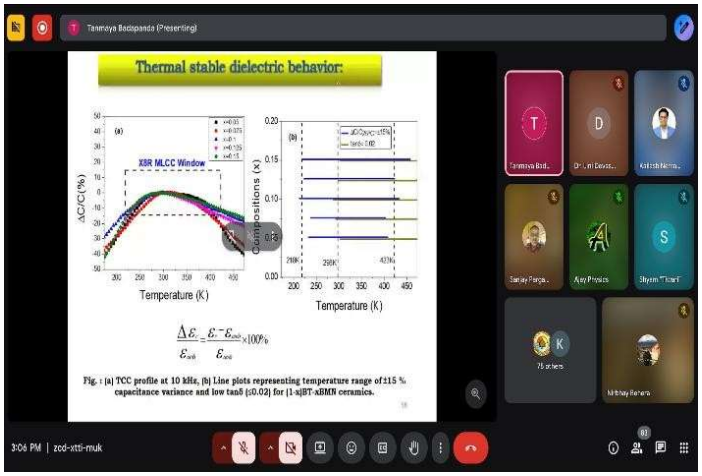
Speaker

Prof. Tanmaya Badapanda
Professor
Dept. of Physics,
C V Raman Global University, Bhubaneswar

Title of lectures: Dielectric materials and its applications -II

In this session Prof. Tanmaya Badapanda presented research on ferroelectric and relaxor ferroelectric materials, focusing on their dielectric and piezoelectric properties for energy storage applications. Then he discussed converting normal ferroelectrics into relaxors through doping with bismuth, zinc, and niobium to enhance disorder, lower transition temperatures, and improve breakdown strength. The synthesis process involved heating oxides and carbonates, calcination, pellet structuring, and sintering, yielding single-phase materials confirmed by X-ray diffraction, with a structural shift from cubic to tetragonal due to doping. Prof. Badapanda analyzed dielectric properties, noting frequency-dependent maximum dielectric temperature and calculating the diffusive parameter gamma (approaching 2 for relaxors) using modified Wise and Q laws. He detailed the methods to determine freezing and burn temperatures, local order parameters, and electromechanical parameters like D_{33} and G_{33}, crucial for piezoelectric applications. The composition with 0.01 bismuth showed high energy storage and breakdown strength due to optimal grain size and polar nano-regions, with thermal stability within 10% from -25°C to 100°C and efficiency variations below 5%. Structural analysis via Lorentzian fitting revealed high local order at 0.02 composition, supporting direct pole coincidence. Prof. Badapanda emphasized standardized measurements for mechanical strength and conductivity, using poling and impedance analysis to derive parameters like planar coupling coefficient and quality factor, optimizing materials for sensor and actuator applications. Vote of thanks was delivered by Dr. Nirbhay Kumar Behera.

Two screenshots from Google Meet are shown below. The session ended with QA session and vote of



DAY: 11 (30.07.2025)

Chairperson/Reporter: -

(1) Dr. Manju Tiwari
(2) Dr. Mohammed Wasim Shaikh

Session -I (10:30am to 12:00 noon) Lecture-32

Speaker
Dr. Shiva Kumar
Principal Research Scientist
IISc Bangalore

Title of Lecture- "Introduction to Luminescence Materials: Applications in White LEDs, Photocatalysis for Energy and Environmental Remedy"

The session delivered by **Dr. C. Shivakumara**, Solid State and Structural Chemistry Unit, IISc Bangalore, focused on the fundamentals of luminescent materials, their synthesis, properties, and applications in energy and environmental solutions. The session began with an overview of **materials science and engineering**, tracing the historical progression from the Stone Age to the era of advanced functional materials. Dr. Shivakumara emphasized the relationship between the **structure, properties, processing, and performance** of materials.

A major focus was on **phosphor materials**, their **host lattices**, activators (rare-earth or transition metal ions), and sensitizers that enhance luminescence. Various synthesis techniques—including solid-state reactions, precipitation, sol-gel, and combustion methods—were discussed for producing efficient phosphors.

Special attention was given to **metal tungstates (MWO_4)**, **molybdates ($AMoO_4$)**, and **bismuth oxyhalides (BiOX)** doped with Eu^{3+}, Dy^{3+}, and Tb^{3+}. Their **photoluminescence properties** were demonstrated, highlighting applications in **white LEDs, display devices, and lasers**.

Dr. Shivakumara also explored **photocatalytic properties** of these materials for **environmental remediation**, particularly in degrading toxic dyes like methylene blue and rhodamine B under UV and visible light. **Band gap engineering** and **co-doping strategies** were shown to enhance both luminescence and photocatalytic efficiency.

The presentation concluded by emphasizing the interdisciplinary relevance of these materials in **energy-efficient lighting, environmental sustainability, and advanced display technologies**, along with their potential for **industrial and research applications**.

Session -II (12:15 PM to 01:45 PM) Lecture-33

Speaker
Dr. Pratap K. Sahoo
Professor
NISER, Bhubneswar

Title of Lecture- "Hydrophobicity through Quantum Particle Effect for Societal Benefit"

Dr. Pratap K. Sahoo from the School of Physical Sciences at NISER Bhubaneswar delivered an in-depth online lecture titled *"Hydrophobicity through Quantum Particle Effect for Societal Benefit"*. The session aimed to explore how quantum-level interactions and nanoscience can enhance hydrophobic properties in materials, offering substantial real-world applications. With over 80 participants attending virtually, the session was both academically enriching and practically oriented.

The lecture began by introducing the fundamentals of **hydrophobicity**, defined as a surface's ability to repel water. A **contact angle** is the primary metric used to classify surface wettability. A surface is considered hydrophilic if the angle is less than 90°, hydrophobic if greater than 90°, and **superhydrophobic** if it exceeds 150°, resulting in water droplets bouncing off the surface. Dr. Sahoo presented compelling natural examples such as lotus leaves, water striders, and nasturtium leaves, where evolutionary design has led to extremely water-repellent surfaces. These were linked to principles in surface energy and the minimization of liquid-solid interactions.

A key theoretical framework discussed was **Alan Turing's reaction-diffusion mechanism**, typically associated with biological pattern formation such as animal skin pigmentation. Dr. Sahoo explained how this model applies to **nano-material structuring**, particularly in the spontaneous formation of intermetallic compounds. This was followed by a detailed exploration of the **$NiBi_3$–Ni system**, where superconducting and ferromagnetic materials interact. $NiBi_3$, a superconductor with a critical temperature of 4.1 K and orthorhombic structure, and Ni, a ferromagnetic material, form self-organizing nanostructures at their interface. These structures are influenced by local inhomogeneities and are believed to follow a Turing-type diffusion-reaction model.

The lecture moved on to **surface tension** and **capillary action**, foundational phenomena in fluid mechanics and surface science. Dr. Sahoo described modern advancements that allow the measurement of surface tension to a precision of ±0.05 nN/m. Using **Young's equation**, the contact angle on a surface was mathematically tied to interfacial energies, which determine whether a liquid wets or beads on a given surface. Concepts of adhesion and cohesion were revisited through everyday examples, such as the behavior of water droplets on waxed versus unwaxed surfaces.

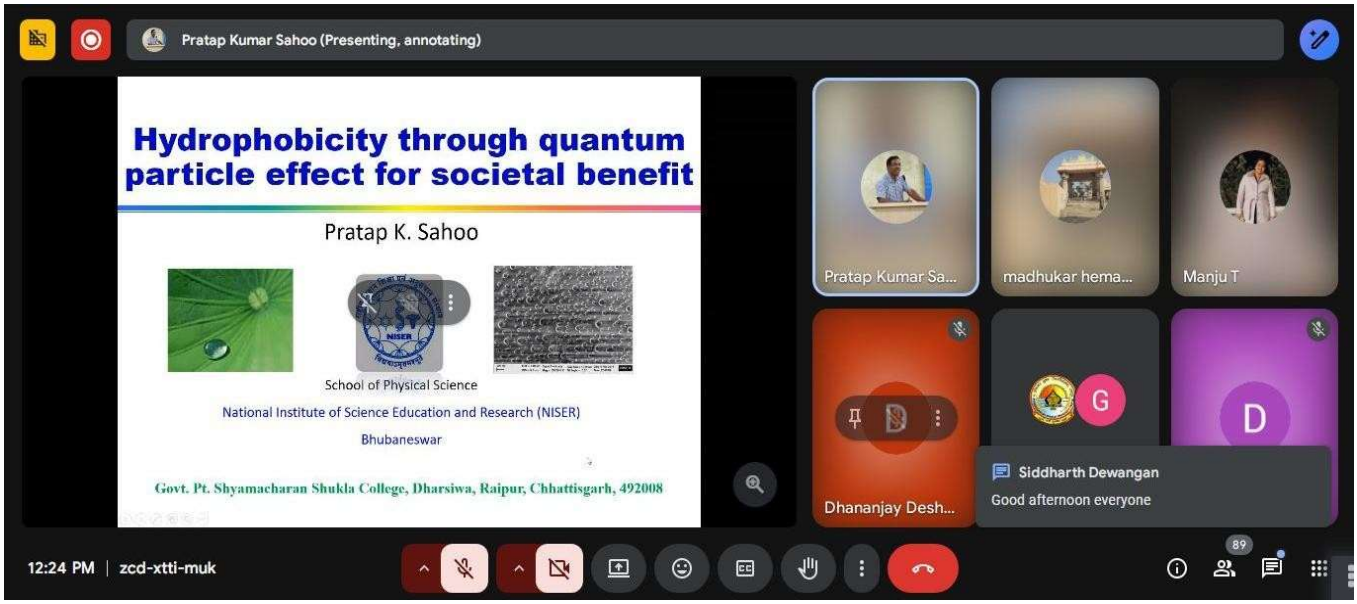
Two major **wetting models** were described in detail: the **Wenzel model**, where a liquid completely wets rough surfaces by filling the grooves, and the **Cassie-Baxter model**, where the liquid rests atop the surface asperities, trapping air and enhancing hydrophobicity. These models were demonstrated through both simulations and real-world examples. Diagrams showed how surface texture amplifies the inherent wettability of a material and leads to superhydrophobic behavior.

Dr. Sahoo also presented experiments and observations using **scanning electron microscopy (SEM)** to

illustrate the morphology of fabricated nanostructures. Surface classification based on contact angles was presented, emphasizing how altering micro- and nano-scale surface features can transform hydrophilic surfaces into hydrophobic or even superhydrophobic ones.

Toward the end of the talk, the discussion turned to **applications**. These included **self-cleaning surfaces**, **anti-fogging and anti-corrosive coatings**, **water-repellent textiles**, and **energy-efficient electronic components**. Emphasis was placed on how quantum particle effects and material science innovations have direct **societal implications**, from improving consumer products to contributing to environmental sustainability.

The lecture concluded with a reflection on interdisciplinary research, highlighting the synergy between quantum physics, materials science, and biology in developing next-generation hydrophobic materials. Dr. Sahoo encouraged students and researchers to approach such complex phenomena with a cross-disciplinary lens, pointing out that curiosity and fundamental understanding are the bedrock of innovation.



DAY: 12 (31.07.2025)

Chairperson/Reporter: -

(1) Dr. Leena Chetan Joshi
(2) Dr. Julin Joseph

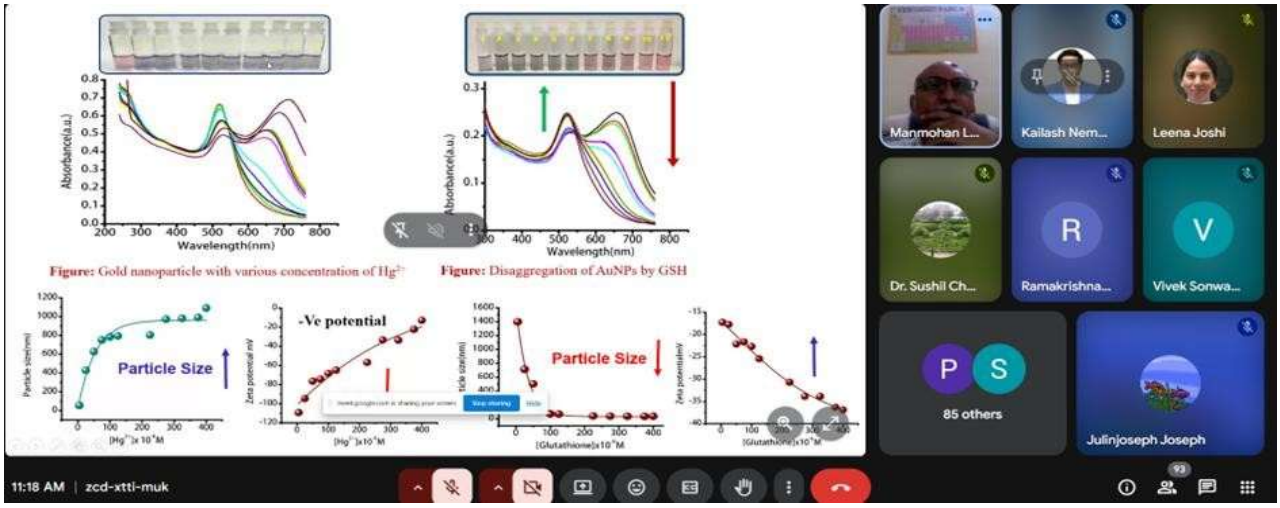
<u>Session -I (10:30am to 12:00 noon) Lecture 34</u>

Speaker
Dr. Manmohan Satnami
Associate Professor
Pt. Ravishankar Shukla University, Raipur

The speaker began by explaining the fundamentals of nanomaterials, including their classification based on composition, dimensions, applications, and crystallinity. He emphasized the importance of multidisciplinary research in advancing the field of nanotechnology.

He then discussed the use of nanomaterials in biomedical applications, specifically as contrast agents, nanoenzymes, and nanoceria. The talk also included a brief overview of ongoing research in his laboratory, particularly focusing on carbon dots and gold nanoparticles.

Additionally, he highlighted studies related to sensing applications, with a focus on fluorescence-based techniques and Förster Resonance Energy Transfer (FRET).



Session – II (12:15 to 13:45) Lecture -35

Speaker

Prof. Meeta Jha
Former Professor
School of Studies in Psychology
Pt. Ravishankar Shukla University, Raipur

Title of Lecture- "Mental Health"

Prof. Meeta Jha delivered an insightful lecture on the topic **"Mental Health,"** covering various essential aspects of overall well-being.

She began by defining **health** as a state of complete physical, mental, and social well-being—not merely the absence of disease. She then focused on **mental health**, explaining it as a crucial component of overall health that includes emotional, psychological, and social well-being. Mental health affects how people think, feel, act, handle stress, relate to others, and make choices.

The lecture highlighted the **importance of mental health**, emphasizing its impact on personal and professional life, relationships, and the ability to cope with challenges.

Prof. Jha also discussed the **signs of good mental health**, such as:

- The ability to manage emotions
- Positive relationships
- A sense of purpose
- Effective coping mechanisms

She contrasted this with **signs of mental health conditions**, which may include:

- Persistent sadness or anxiety
- Withdrawal from social interaction
- Changes in sleep or appetite
- Difficulty concentrating

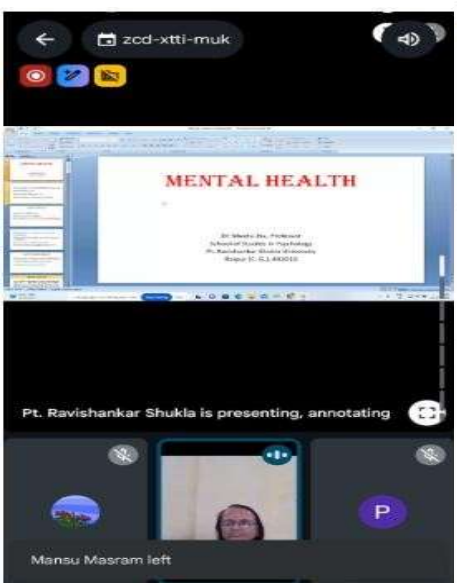
Common **mental health disorders** like depression, anxiety disorders, and stress-related conditions were explained with clarity.

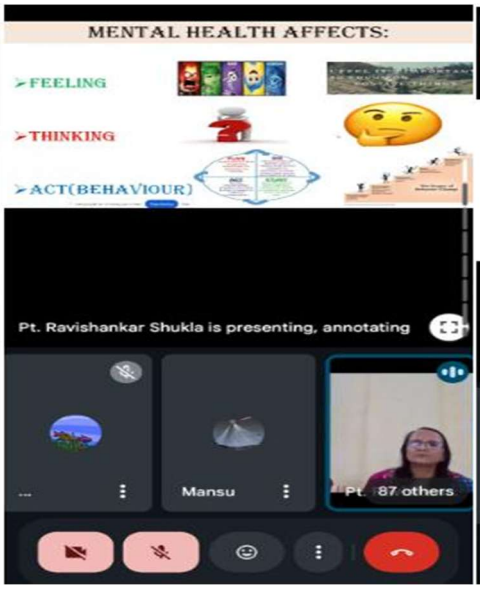
She then summarized the **various aspects of health**, stating that **good health requires**:

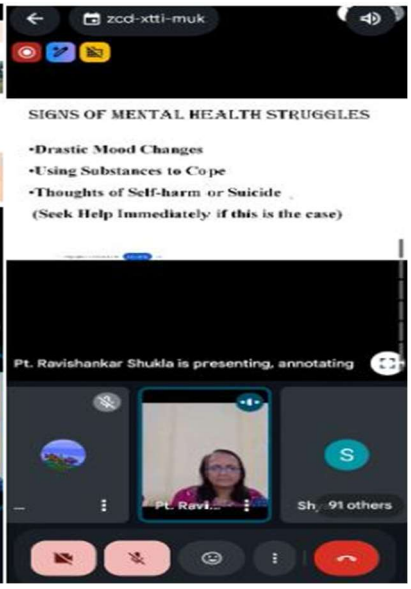
- Proper **nutrition**
- Adequate **water** intake
- Sufficient **rest**
- Emotional **trust** and support

Finally, Prof. Jha provided guidance on **how to support and enhance mental health**, such as:

- Building supportive relationships
- Practicing mindfulness and relaxation techniques
- Seeking professional help when needed
- Maintaining a balanced lifestyle







Valedictory function

The valedictory function of the **Refresher Course** was held on **31.07.2025** at **4:00pm** with great enthusiasm. The event marked the successful completion of the course, which aimed to enhance the academic and professional capabilities of the participating faculty members.

The program commenced with a **welcome address** by **Course Coordinator Dr. Arvind Agrawal**. Course coordinator Prof. Nameeta Brahme gave a concluding note highlighting the objectives of the refresher course, its schedule, and the active participation of the attendees. The course coordinator also expressed gratitude to the resource persons and the participants for their cooperation and engagement throughout the sessions.

The **Program Director, Prof. Preeti Suresh**, in her address, appreciated the efforts of the organizing team and underlined the importance of continuous learning and faculty development programs. She also emphasized that such courses play a vital role in upgrading the teaching and research skills of educators in line with the latest academic trends.

The **Hon'ble Vice Chancellor, Prof. Sachchidananda Shukla**, graced the occasion as the **Chief Guest**.

In his valedictory address, the Vice Chancellor congratulated the participants on the successful completion of the course and encouraged them to implement the knowledge and skills gained in their respective institutions. He also commended the organizing team for their dedication and successful coordination of the program.

The event concluded with a **vote of thanks** delivered by assistant course coordinator **Dr. G Nag Bhargavi**, who extended gratitude to the Vice Chancellor, Program Director, Course Coordinator, resource persons, and participants for making the event a grand success.

The valedictory function reflected the spirit of academic collaboration and highlighted the significance of faculty enrichment programs in fostering a culture of excellence in higher education.


Arvind Agrawal
ashishsetokar
Manju T
Ramakrishnan S
Kailash Nemade
G Nag Bhargavi
Nameeta Brahme
Vivek Sonwane
Sandeep Patil
Dr. Umesh Kumar ...
Siddharth Dewang...
Puneet Kumar Pan...
dinesh kumar chit...
Nirbhay Behera
Rohit kumar Seth
Leena Joshi
Vijay Sharma
Shyam "Tiwari"
Dr. Sushil Chande
Joga Singh
Parvin Shaikh
Narayan Gaonkar
Hitesh kumar Neta...
Sanjay Parganiha
Hempushpa Chan...
rashmi priya toppo
54 others
Preeti Suresh
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