

## Report for Refresher Course in Physical Sciences

The Gandhigram Rural Institute – Deemed to be University (GRI-DTBU) organized a UGC Sponsored Online Interdisciplinary Refresher Course in Physical Sciences from 25th September to 8th October 2024 under the Malaviya Mission Teacher Training Programme. This course provided a platform for assistant professors and young faculty members to enhance their knowledge, teaching methods and research capabilities while promoting interdisciplinary learning. Since the course was conducted entirely online, it was accessible to participants from various institutions across the country, with a total of 20 participants members from disciplines such as Physics, Chemistry, and Materials Science.

The refresher course included sessions delivered by distinguished speakers from prestigious institutions such as DRDO, IISER, NIT, CSIR-Central Electrochemical Research Institute, CSIR-Fourth Paradigm Institute, Gandhigram Rural Institute, Madurai Kamaraj University (MKU) and Sri Venkateswara University, Tirupati. These experts were invited to share their insights and knowledge. They also provided 5 to 7 multiple-choice questions (MCQs) for participant assessments at the end of their sessions, helping gauge the participant's understanding.

The wide range of topics was covered during the course, ensuring participants gained a comprehensive view of the latest developments in Physical Sciences. These topics included fundamentals and applications of spectroscopy, Photoelectrochemical, Organic Semiconductors, Lasers - Fundamentals and Applications, glasses for radiation shielding applications, Electrochemical Energy Storage Systems, Biopolymers, Importance of Patenting in Research, Introduction to AI & ML (Artificial Intelligence & Machine Learning) disruptions in teaching Physical Sciences and Quantum Mechanics. These sessions encouraged participants to engage in discussions, ask questions, and gain practical insights from the invited experts. The course emphasized an interdisciplinary approach, helping participants understand the connections between fields such as Physics, Chemistry, and Materials Science.

Throughout the course, the participants were actively engaged in lectures, discussions and assessments, with the MCQ-based evaluations allowing them to test their grasp of the material covered. The interactive format helped ensure that the participants could apply the knowledge in their teaching and research work, while also broadening their perspective on interdisciplinary collaboration. Feedback from the participants was highly positive, with many

appreciating the variety of topics and the opportunity to interact with leading experts from different fields.

The course concluded with a Valedictory Function on 8th October 2024, conducted via Google Meet. The event was presided over by Dr. L. Rathakrishnan, Registrar (i/c) of GRI, Gandhigram. Dr. G. Muralidharan, Senior Professor, Department of Physics, GRI, delivered the Valedictory Address. Dr. A. Jahitha Begum, Head of the Department and Senior Professor in the Department of Education, GRI, delivered the Special Address. Dr. K. Marimuthu, Program Coordinator and Professor in the Department of Physics, GRI, presented the Welcome Address. Finally, Dr. P.S. Sreedevi, Programme Director of UGC-MMTTC at GRI, delivered the Vote of Thanks, expressing her gratitude to the University Grants Commission (UGC) for sponsoring the course under the Malaviya Mission Teacher Training Programme, and to all the invited speakers and participants for their active involvement. She also acknowledged the efforts of the organizing committee and technical staff for ensuring the smooth conduct of the program.



**UGC-Malaviya Mission Teacher Training Centre  
Department of Education  
The Gandhigram Rural Institute – Deemed to be University,  
Gandhigram-624 302, Dindigul Dt, Tamilnadu.**



**INTERDISCIPLINARY REFRESHER COURSE- PHYSICAL SCIENCES**  
(For Faculty in Universities/Colleges/Institute)  
Training Program ID: GRI/UGC-MMTTC/RC01(ON)-PS/2024  
(25.09.2024 to 08.10.2024)

**PROGRAMME REPORT**



**Organized By**  
**DEPARTMENT OF EDUCATION**  
**The Gandhigram Rural Institute (Deemed to be University)**

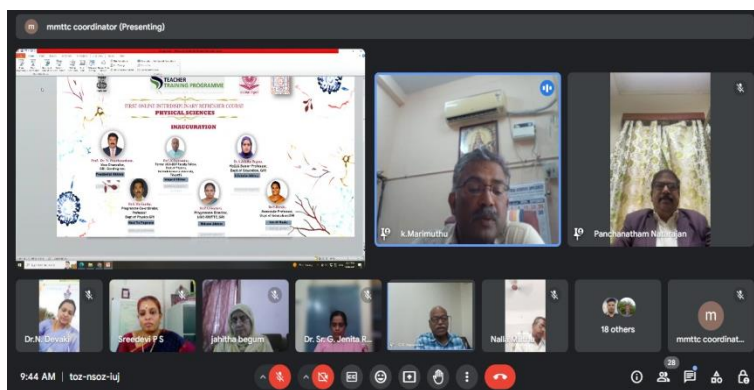
Under  
**UGC-Malaviya Mission Teacher Training  
Centre Ministry of Education (MOE)  
Government of India.**

## Report on Inaugural session

A Twelve days Online Interdisciplinary Refresher Course in Physical Sciences for Faculty in Universities/Colleges/Institute has organized by Department of Education, The Gandhigram Rural Institute (Deemed to be University), Gandhigram, under the UGC-Malaviya Mission Teacher Training Centre, Ministry of Education (MOE), Government of India.

Dr. P. S. Sreedevi, Programme Director, UGC-MMTTC welcomed the gathering. Dr. K. Marimuthu Professor, Department of Physics & Programme Coordinator who elaborated the need and significance of the Refresher Course and explained the guidelines to be followed during the session. Revered Vice Chancellor of the Gandhigram Rural Institute , Professor Dr. N. Panchanatham, motivated the participants by his presidential address in which he highlighted the importance of lifelong learning for teaching and the concept of learn, relearn and unlearn. Dr. Jahitha Begum, HoD, Department of Education felicitated the gathering. Dr. C. K. Jayasankar former UGC-BSR Faculty fellow, Chief Guest, in his inaugural address emphasized the value and the emerging trend and challenges in Physical Sciences and also he delevated the duties and role of the teachers to update themselves in their areas of specialization. Dr. N. Devaki , Associate Professor, Department of Education Proposed vote of thanks.

For this two weeks Refresher Course Resource Persons were invited from various Universities and Research Institutes from all over India and across India. All the sessions were designed around the theme to empower and enrich the skills of participants.



**Date: 25.09.2024**

**Time: 10.00 am to 01.00 pm**

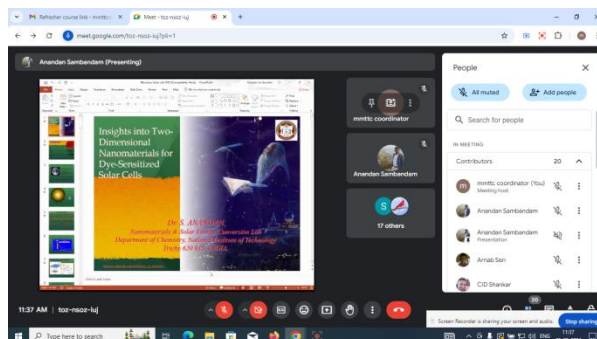
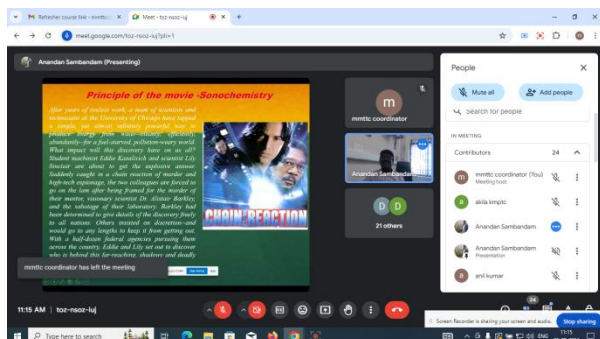
**Resource Person: Dr.S.ANAND**

**Resource Topic: “How did Chemistry Become a Science?”**

Dr. S. Anand, a Professor at NIT Trichy, led the first session of the UGC-sponsored Interdisciplinary Refresher Course in Physical Science. His lecture, titled “How Did Chemistry Become a Science?”, explored Chemistry's historical evolution. Dr. Anand highlighted early attempts to transform materials and the subsequent development of systematic inquiry in



Chemistry. Key milestones included Boyle's emphasis on empirical data, Lavoisier's identification of oxygen and combustion, and Mendeleev's Periodic Table. These advancements marked the transition of Chemistry from mystical alchemy to a rigorous scientific discipline. Dr. Anand underscored how these figures and their contributions laid the foundation for modern Chemistry, integrating empirical methods and systematic categorization of elements.



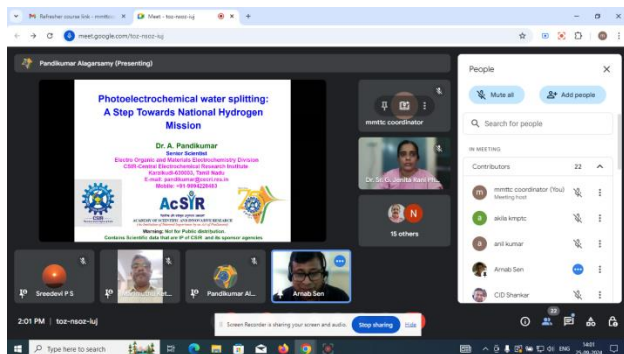
**Date: 25.09.2024**

**Time: 02.00 p.m. to 05.00 p.m**

**Resource Person: Dr.A.PANDIKUMAR**

**Resource topic: Photo electrochemical water splitting: A step towards National Hydrogen Mission**

On 25.09.2024, Dr. A. Pandikumar, Senior Scientist at CSIR-CECRI, delivered a lecture on photoelectrochemical water splitting, explaining its role in producing hydrogen fuel from water using solar energy. He discussed semiconductor materials like metal oxides and catalysts that enhance the process. His research on bismuth molybdate graphitic carbonate nitrate was also shared. In the Q&A session, participants explored practical applications and sustainability concerns. In Session II, Dr. Pandikumar discussed dye-sensitized solar cells (DSSCs), focusing on their structure, materials like  $\text{TiO}_2$ , and the challenges in improving efficiency and stability. His work on  $\text{Au-Ag@TiO}_2$  DSSCs was highlighted. The day concluded with a vote of thanks by Dr. G. Jenita Rani, Assistant Professor at Fatima College, Madurai.



**Date: 26.09.2024**

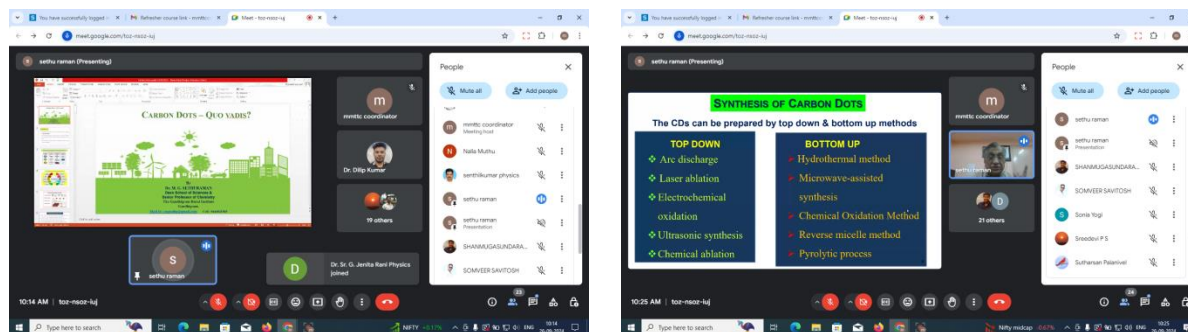
**Time: 10.00 a.m to 01.00 p.m**

**Resource Person: Prof.M.G.SETHURAMAN**

**Resource Topic: Carbon dots-Quovadis**

Prof. Sethuraman's presentation focused on Quantum Dots (QDs), nanoscale semiconductor particles with unique optical and electronic properties due to quantum confinement. He explained QD synthesis through top-down (lithography, etching) and bottom-up (colloidal synthesis, molecular beam epitaxy) techniques. Various characterization methods, like spectroscopy and microscopy, were discussed, along with QD applications in solar cells, medical imaging, quantum computing, and environmental solutions.

Additionally, he explored the Indian knowledge system, blending ancient wisdom (Vedic literature, Ayurveda) with modern advancements (IT, space exploration, sustainability). This fusion of tradition and innovation reflects India's holistic approach to science, health, and environmental sustainability.



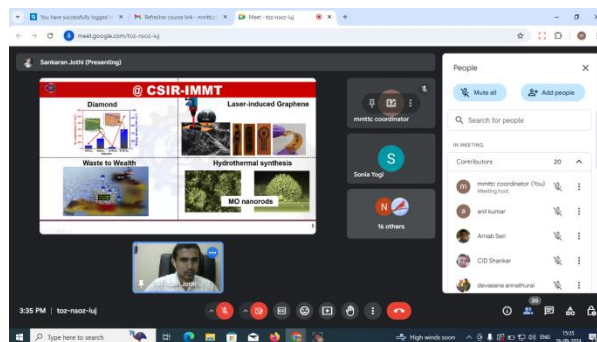
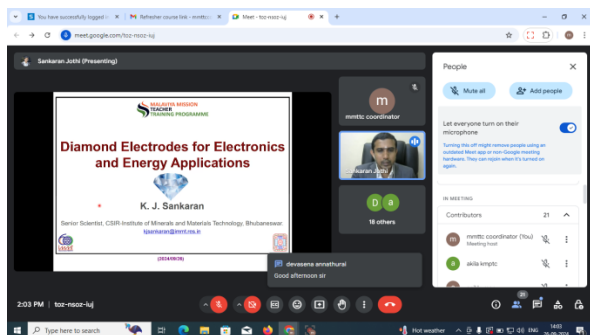
**Date: 26.09.2024**

**Time: 2.00 p.m to 5.00 p.m**

**Resource Person: Dr.K.J.SANKARAN**

**Resource Topic: Diamond Electrodes for Electronics and Energy Applications**

Prof. Dr.K.J.SANKARAN lecture began with an overview of CSIR and its departments, followed by a discussion on carbon allotropes, focusing on diamond and its crystal structure. He explained diamond film growth techniques like chemical vapor deposition (CVD) and discussed field electron emission, NUNCD films, and graphene polymers. The session covered the fabrication and applications of laser-induced graphene (LIG) structures, including their use in electronic displays and photocatalytic dye degradation. The lecture concluded with insights into the efficiency and stability tests of LIG materials, making it a highly informative and engaging experience.



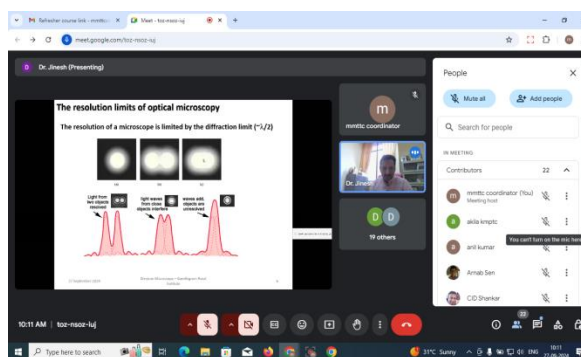
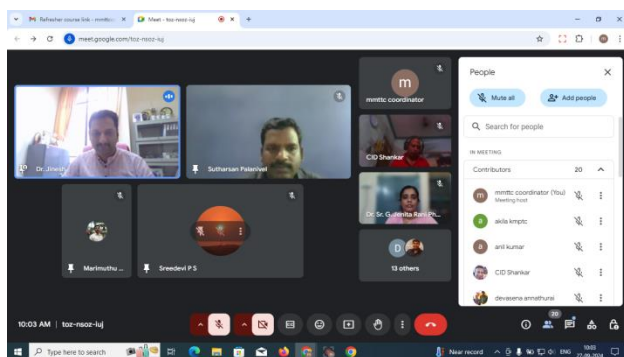
**Date: 27.09.2024**

**Time: 10.00 a.m to 1.00 p.m**

**Resource Person: Prof.K.B.JINESH**

**Resource Topic: Electron Microscopy for Material Analysis**

The growing threat of global warming has pushed electric mobility (EM) and renewable energy as key solutions to reduce greenhouse gas emissions. Li-ion batteries (LIBs), essential for EM, rely on raw materials like cobalt and lithium, raising environmental and geopolitical concerns. Reusing LIBs as second-life batteries (SLBs) can address these issues. LIBs, recognized for their high energy efficiency, long cycle life, and reduced costs, have revolutionized technology, powering electric vehicles and portable electronics. Key battery types include lithium polymer and lithium cobalt oxide for energy density, and lithium iron phosphate and NMC for longer life and use in renewable energy systems. LIBs operate with a positive and negative electrode, separated by an electrolyte. Electrochemical cells have diverse applications, including metal refining, battery production, and clean energy generation through fuel cells.



**Date: 27.09.2024**

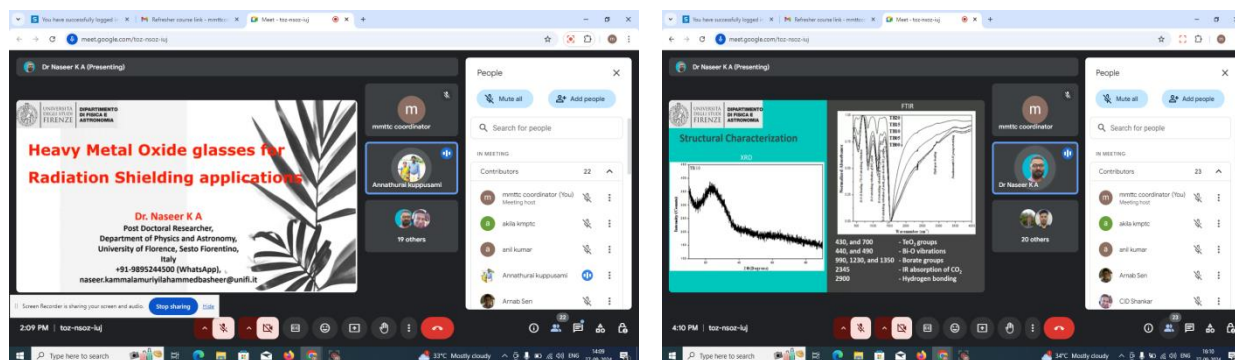
**Time: 2.00 p.m to 5.00 p.m**

**Resource Person: Dr.NASEER.K.A**

## Resource Topic: Heavy metal oxide glasses for radiation shielding applications

Dr. K A Naseer, Postdoctoral Fellow at the University of Florence, delivered a lecture on "Heavy Metal Oxide Glasses for Radiation Shielding Applications." He explored the structure, composition, and advantages of heavy metal oxide (HMO) glasses, which incorporate high-density oxides like  $\text{PbO}$ ,  $\text{Bi}_2\text{O}_3$ , and  $\text{WO}_3$ . These glasses offer effective radiation shielding, especially in medical imaging and nuclear energy, and can be transparent, unlike traditional materials. HMO glasses absorb low-energy radiation, scatter intermediate energy, and convert high-energy photons into particle pairs, enhancing protection.

Their applications include shielding windows in X-ray rooms and nuclear reactors. The lecture concluded by emphasizing the potential for future innovation in radiation protection technologies.



**Date: 28.09.2024**

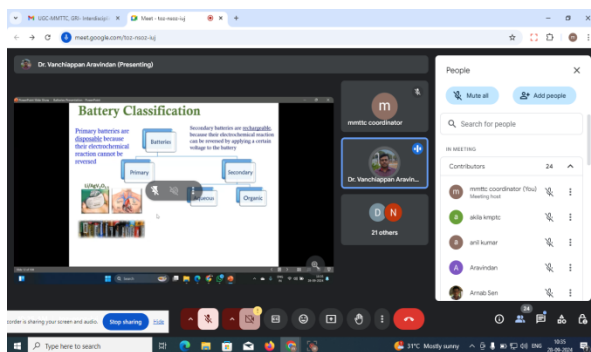
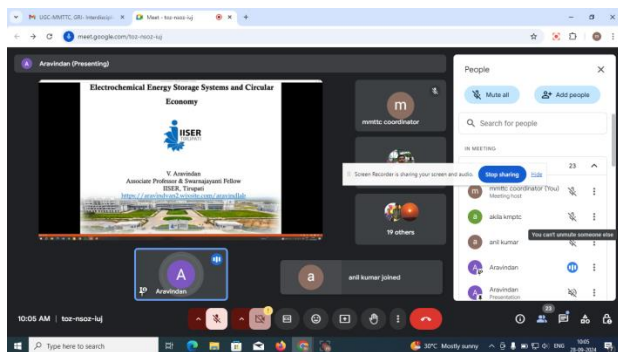
**Time: 10.00 a.m to 1.00 p.m**

**Resource Person: Dr.V.ARAVINDAN**

**Resource Topic: Electrochemical Energy Storage Systems and Circular Economy**

Dr. V. Aravindan delivered an insightful presentation on energy storage technologies, exploring a wide array of topics. These included a comparison of energy storage technologies, the transition from chemical reactions to electrochemical cells, and the fundamental requirements of such cells. He delved into energy storage mechanisms, theoretical specific energy of batteries, the role of electrodes and electrolytes, and various battery classifications. The presentation highlighted the applications of Li-ion batteries, advancements in electrochemical technology, Na-ion batteries, supercapacitors, and Li-ion capacitors. Electrochemical characterization was also covered. Overall, the presentation was excellent and highly engaging.





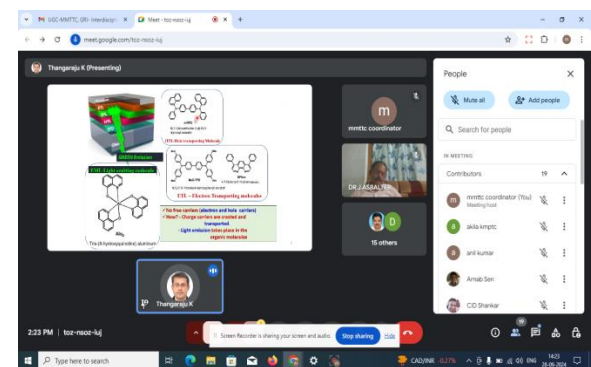
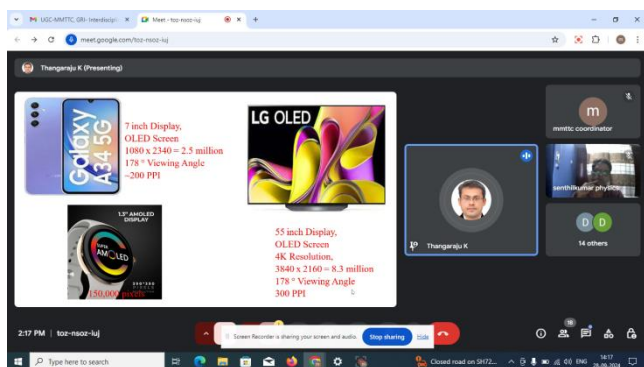
**Date: 28.09.2024**

**Time: 02.00 p.m to 5.00 p.m**

**Resource Person: Dr.K.THANGARAJU**

**Resource Topic: Organic Semiconductors and Organic/Inorganic Hybrid thin films for Optoelectronic Applications.**

Organic semiconductors and organic/inorganic hybrid thin films are gaining attention for their unique properties in optoelectronics, including flexibility, lightweight, and tunable electronic characteristics. Organic semiconductors, made of  $\pi$ -conjugated carbon-based systems, are used in OLEDs, organic photovoltaics, and OFETs due to their high efficiency and flexibility. Organic/inorganic hybrid thin films combine the strengths of both material types, improving charge mobility, stability, and versatility for applications like hybrid LEDs, solar cells, and sensors. Despite their promise, challenges like stability and scalability remain. Future research focuses on enhancing material design, fabrication, and interface engineering to improve performance and stability for next-generation devices.



**Date: 29.09.2024**

On 29.09.2024 the allocated Assignments for the participants(20) are received by the Co-ordinator mail to assess their papers.

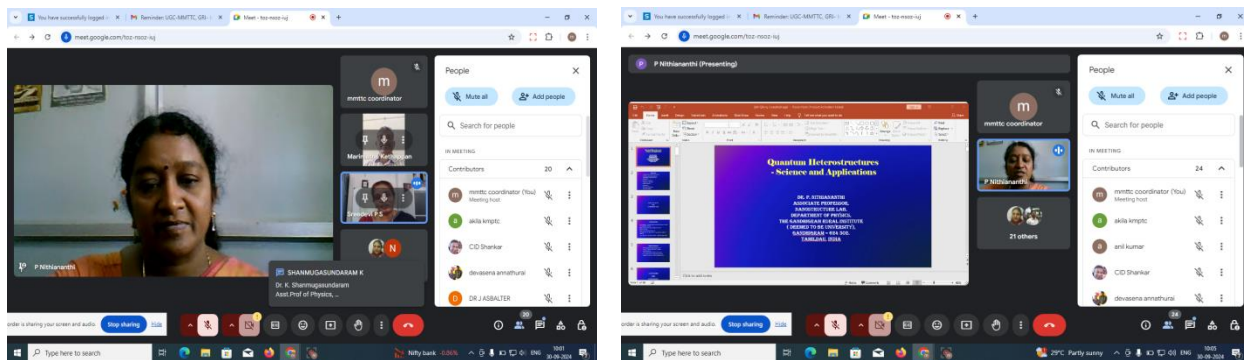
**Date: 30.09.2024**

**Time: 10.00 a.m to 1.00 p.m**

**Resource Person: Dr.P.NITHIANANTHI**

## Resource Topic: Quantum hetero structures-Sciences & Applications.

On the sixth day of the UGC-Malaviya Mission Interdisciplinary Refresher Course in Physical Sciences, Dr. P. Nithiananthi, Associate Professor at GRI, delivered a lecture on quantum heterojunction science and its applications. The session began with a welcome address and speaker introduction by Dr. Rekha Rani Agarwal, Professor at Poornima Institute of Engineering and Technology, Rajasthan. Dr. Nithiananthi explained the concept of quantum heterojunctions, highlighting the limitations and advantages of heterojunction devices. The speaker also discussed techniques used in materials analysis to examine the microstructure, chemical, and mineralogical compositions of nanoparticles. Emerging research trends in quantum hetero structures were presented, with emphasis on the potential development of stabilizing materials in the future. The session concluded with an engaging Q&A, where participants' queries were addressed. The vote of thanks was delivered by Dr. P. Sutharsan, Assistant Professor at Sir Theagaraya College, Chennai.



**Date: 30.09.2024**

**Time: 02.00 p.m to 5.00 p.m**

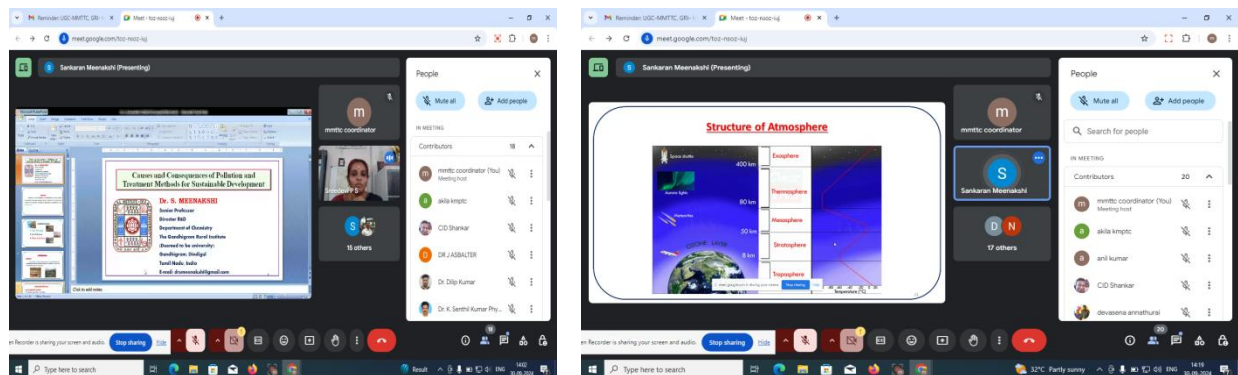
**Resource Person: Dr.S.MEENAKSHI**

**Resource Topic: Sustainable technologies for water treatment**

The afternoon session of the Interdisciplinary Refresher Course in Physical Sciences began with a welcome from Program Director Dr. P.S. Sreedevi of UGC-MMTTC, Gandhigram Rural Institute. She emphasized the significance of interdisciplinary approaches in physics. Dr. Dhilip Kumar Meena introduced the resource person, Dr. S. Meenakshi, Senior Professor of Chemistry at GRI, highlighting her research expertise in sustainable technologies. Dr. Meenakshi delivered a presentation on sustainable technologies and water treatment, addressing environmental challenges and the role of physics in finding solutions. Participants were engaged and benefited from her clear explanations.

An interactive Q&A session followed, allowing participants to seek clarifications, which Dr. Meenakshi addressed thoughtfully. The session concluded with a vote of thanks from Dr. K. Shanmugasundaram, Assistant Professor of Physics at Government Arts and Science College. He

expressed gratitude to Dr. Meenakshi for her insights, Dr. Sreedevi for her leadership, and the organizing team for their efforts. He also thanked participants for their engagement, contributing to a successful session that enhanced understanding of sustainable technologies and water treatment.



**Date: 01.10.2024**

**Time: 10.00 a.m to 1.00 p.m**

**Resource Person: Dr.V.VASU**

**Resource Topic: 1. Thin film solar cells and their applications.  
2. Density functional theory and their applications.**

In the first session, director Dr.P.S.Sreedevi madam inaugurated the session & Co-ordinator Dr.K.Marimuthu sir gave a slight intro about the Resource Person and in continuation Dr.K.Senthilkumar gave a brief intro about the Resource Person. Then the session was taken over by Dr.V.Vasu . He had splitted the session into two: 1) Density functional theory and their applications. 2) IInd session was on thin film solar cells and their applications, there he had explained basics of solar cells and why we could not commercialised solar cells and their future challenges. The Resource Person gave some very important tips for the participant's computational research that VASP, Quantum Express, AVAGADRA, X CRYSTDENSE,etc.. Finally, with a Vote of Thanks was given by one of our participants Dr.J.Asbalter and session was ended smoothly.

**Date: 01.10.2024**

**Time: 2.00 p.m to 5.00 p.m**

**Resource Person: Dr.BASHERRUDIN MAHMUD AHMED**

**Resource Topic: Foundations of Quantum Mechanics I & II**

The afternoon session began at 2:00 p.m. with a welcome from Dr. Sreedevi, Director of UGC-MMTTC, who introduced Resource Person Dr. Basherrudin Mahmud Ahmed. In the first half, Dr. Ahmed discussed the state of the system, explaining Newtonian equations and wave

equations of Lagrangian and Hamiltonian mechanics using digital tablets, making learning engaging and constructive. He highlighted the difference between particles and waves, covering topics such as black body radiation, the photoelectric effect, atomic models, the Bohr atomic model, the Davisson-Germer experiment, and de Broglie's thesis on the dual nature of electrons.

In the second half, starting at 3:45 p.m., Dr. Ahmed focused on the basics of Quantum Mechanics, discussing the position of electrons in wave nature, the time-dependent Schrödinger equation, and Hamiltonian operator concepts. He patiently addressed participants' doubts and provided clear explanations, often referencing real classroom situations. By the end of the session, participants gained valuable insights into quantum mechanics. Gratitude was expressed to the organizing committee for successfully conducting the course.

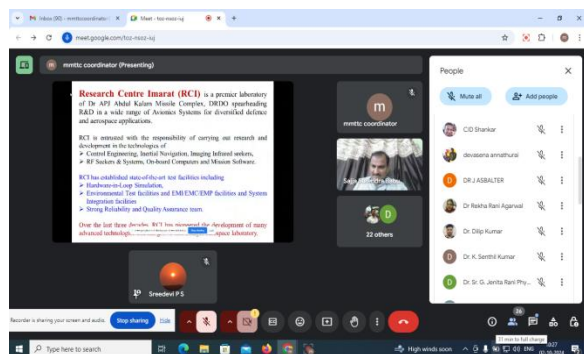
**Date: 02.10.2024**

**Time: 10.00 a.m to 1.00 p.m**

**Resource Person: Dr.S.SURENDRA BABU**

**Resource Topic: Lasers - Fundamentals and Applications**

The first session on October 2, 2024, began with a warm welcome to Dr. S. Surendra Babu, Scientist-F, DRDO, by Dr. P. S. Sreedevi and Dr. K. Marimuthu of GRI, with an introduction by Dr. Sonia Yogi. Dr. Babu's presentation focused on "Lasers – Fundamentals and Applications," starting with insights into DRDO and his role, followed by the Chandrayaan-3 mission's use of laser devices. He discussed India's National Quantum Mission, highlighting quantum communication and computing. Dr. Babu explained the electromagnetic spectrum, photoelectric effect, and the properties of LASER, emphasizing its collimation, monochromaticity, and coherence. He covered laser production, Einstein's coefficient, and classified lasers into three-level and four-level systems, including solid-state, gas, liquid, and semiconductor lasers. The second part of his talk focused on laser applications in defense, detailing non-weapon and directed energy weapon systems. He mentioned non-lethal laser weapons for self-defense and high-power lasers capable of damaging aircraft and missiles. The session concluded with laser safety and a vote of thanks by Arnab Sen, NCERT.





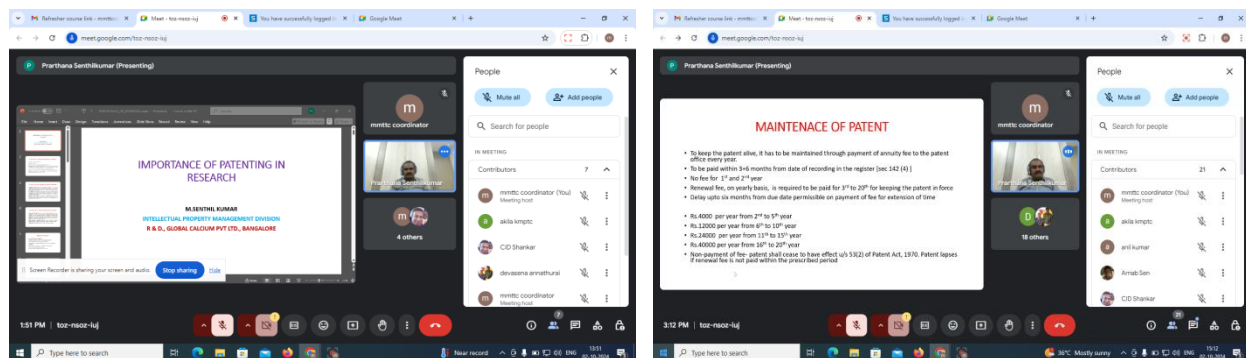
**Date: 02.10.2024**

**Time: 2.00 p.m to 5.00 p.m**

**Resource Person: Mr.K.M.SENTHIL KUMAR**

**Resource Topic: Importance of Patenting in Research**

The presentation began with a welcome address and an introduction to the resource person, followed by an explanation of the meaning and types of Intellectual Property (IP). The importance of IP was then discussed in detail. The speaker elaborated on patents and the criteria for patentability, including novelty, prior art, inventive step, and industrial application. The subject matter of patent protection was explained, covering manufacturing, machines, compositions of matter, and processes, with a reference to a U.S. Supreme Court judgment. The discussion included provisional and complete specifications, along with the concept of PHOSITA for inventive steps. The right time to file a patent, as per the Paris Convention, was highlighted. The process of patent examination, including RFE, FORM-18, and FER, was explained, along with the 20-year maintenance period and associated payments. Non-patentable subject matter under Section 3 of the Patent Act, 1970, and Section 3(d)'s higher standard of obviousness were addressed. A block diagram of CGPDTM was shown, followed by details on patent opposition, international applications through PCT, and a comparison between the PCT system and the Paris Convention. The presentation concluded with a vote of thanks.



**Date: 03.10.2024**

**Time: 10.00 a.m to 1.00 p.m**

**Resource Person: Prof.C.K.JAYASANKAR**

**Resource Topics: 1. Fundamentals and applications of Spectroscopy in Physical Sciences  
2. Physics and Chemistry of rare earth based materials for Photonic Applications**

Prof. C. K. Jayasankar's presentation covered the fundamentals of spectroscopy and rare earth-based materials, highlighting their significance in various scientific applications. Spectroscopy, a technique used to study the interaction between matter and electromagnetic

radiation, is crucial in fields like chemistry, physics, biology, and materials science. Key types of spectroscopy include absorption, emission, Raman, NMR, and mass spectrometry, with applications ranging from chemical analysis to environmental monitoring and astronomy. Rare earth elements (REEs), known for their sharp electronic transitions and luminescent properties, are vital in photonics, with applications in lasers, optical amplifiers, solid-state lighting, and solar energy conversion. REEs' unique electronic structure, minimal interaction with the environment, and ability to up convert and down convert light make them valuable in bio imaging and nonlinear optical devices. The presentation also detailed synthesis methods, such as sol-gel and hydrothermal techniques, and the importance of doping in enhancing luminescent properties. Rare earth materials are widely used in communication, lighting, and sensing technologies, making them a key focus in modern photonic research and development.

**Date: 03.10.2024**

**Time: 2.00 p.m to 5.00 p.m**

**Resource Person: Dr.G.MURALIDHARAN**

**Resource Topics: 1. Energy storage devices of the future- Super capacitor.**

**2. An introduction to Academic Bank of Credits (ABC).**

Prof. Dr. G. Muralidharan's presentation covered key areas in electrochemical energy storage, including materials for energy storage, photovoltaic panels, and technologies like supercapacitors and batteries. He discussed electrochemical double-layer capacitors, supercapacitor mechanisms, and the comparison of capacitors, batteries, and supercapacitors. Pseudo-capacitor materials, nanostructure synthesis, and transition metal sulfides were also highlighted. The session expanded into educational topics, explaining the Choice-Based Credit System (CBCS), National Academic Depository (NAD), and the Academic Bank of Credits (ABC), including its objectives, benefits, and regulations, along with the credit-transfer and redemption mechanisms. Overall, the presentation was excellent.

**Date: 04.10.2024**

**Time: 10.00 a.m to 1.00 p.m**

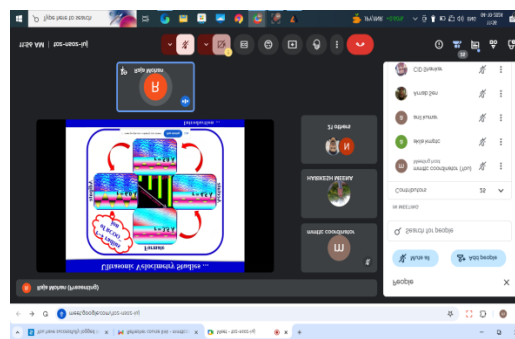
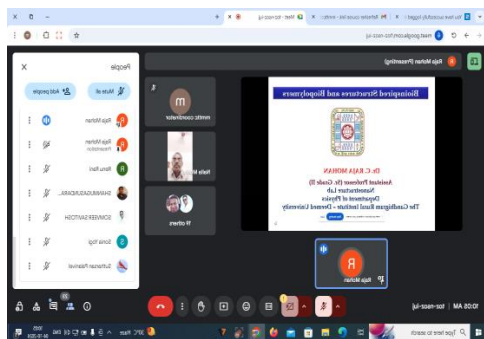
**Resource Person: Dr.C.RAJAMOHAN**

**Resource Topics: Bio-inspired structures and Bio-polymers**

The first session focused on fractal structures, where the Resource Person explained their construction and natural examples interactively. He discussed the morphology of polymer films and their modeling through Fractal Theory, particularly using chitosan dissolved in adipic acid, alongside theoretical and experimental results, including the modeling of bacterial colony growth

with Iterated Function Systems (IFS). The conclusion drawn was that self-similar structures observed in nature can be explained by this model.

In the second session, the Resource Person delivered an illustrative talk questioning the necessity of sophisticated instruments in research. Using a cost-effective ultrasonic interferometer and density bottle, he conducted experiments with chitosan-based biopolymers to measure physical quantities such as ultrasonic velocity, refractive index, and acoustic impedance. These experiments, complemented by FTIR spectra, resulted in numerous publications. He concluded that high-end equipment is not essential for research; valuable research can be conducted with basic instruments.



**Date: 04.10.2024**

**Time: 2.00 p.m to 5.00 p.m**

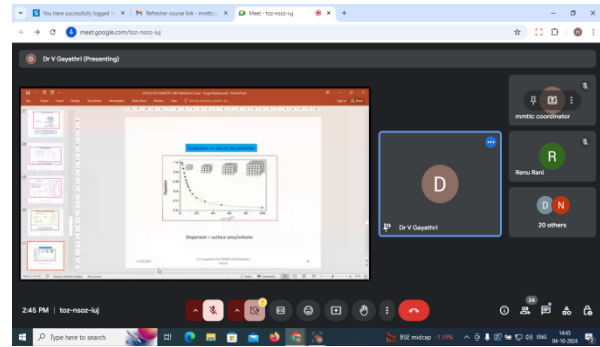
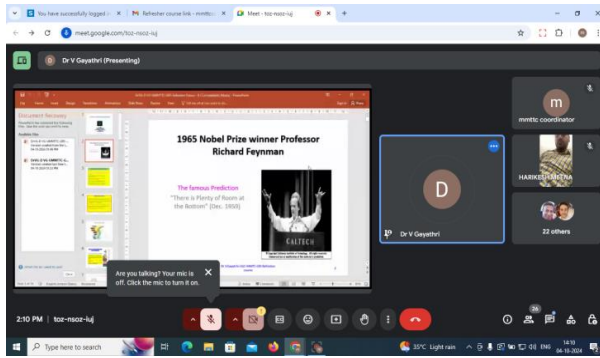
**Resource Person: Dr.V.GAYATHRI**

**Resource Topics: 1. Physics of Materials at Nano level.**

**2. Industrial Development through nanoscale Materials**

Dr. V. Gayathri delivered her invited talk on the physics of materials at the nanoscale, focusing on how materials behave differently at this length scale due to quantum effects. She discussed key topics, including Moore's Law, optical properties, magnetic properties, and structures like C-60 fullerene, nano spheres, and nanotubes. Various microscopic techniques were covered, such as electron microscopy, scanning probe microscopy, UV spectroscopy, Raman spectroscopy, and NMR techniques.

In her second segment, Dr. Gayathri highlighted the industrial development potential through nanoscale materials, emphasizing their unique properties, including altered melting points, fluorescence, and electrical conductivity. She explained how the tunability of material properties based on particle size can lead to significant advancements in applications across healthcare, electronics, cosmetics, textiles, and environmental protection. The session concluded with a vote of thanks by Dr. S. Sivasankaran at 5 PM.



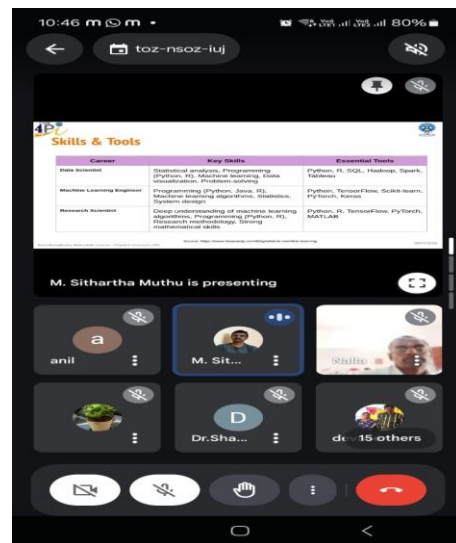
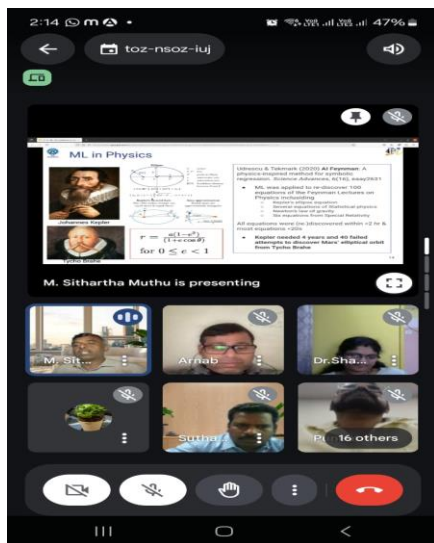
**Date: 05.10.2024**

**Time: 10.00 a.m to 11.30 a.m**

**Resource Person: Dr.M.SITHARTHA MUTHU VIJAYAN**

**Resource Topic: Introduction to AI & ML (Artificial Intelligence and Machine Learning)**

On 5 October 2024, Ms. Harshika Jha from Poornima Institute of Engineering and Technology introduced Dr. M. Sithartha Muthu Vijayan, who led a session on "Introduction to AI & ML." The presentation covered how AI and ML are transforming physical sciences education through personalized learning, data-driven insights, and enhanced engagement with tools like interactive simulations and intelligent tutoring systems. Challenges such as the digital divide, data privacy, and teacher training were discussed, along with the importance of not over-relying on technology. Future trends include AI-enhanced curriculum, collaborative learning, and immersive VR/AR experiences. The session emphasized the need for infrastructure investment, ethical data use, and ongoing educator training. Prof. Dr. Rekha Rani Agarwal concluded the event with a vote of thanks.



**Date: 05.10.2024**



**Time: 2.00 p.m to 3.30 p.m**

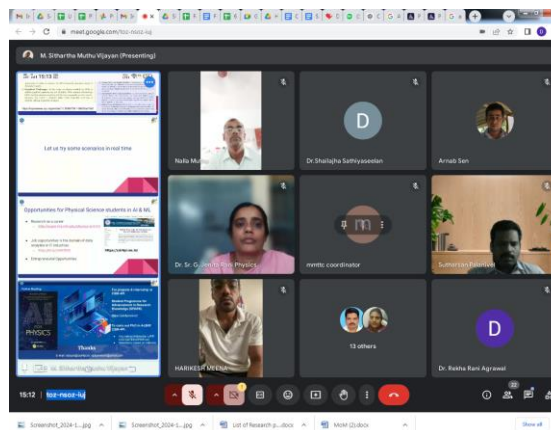
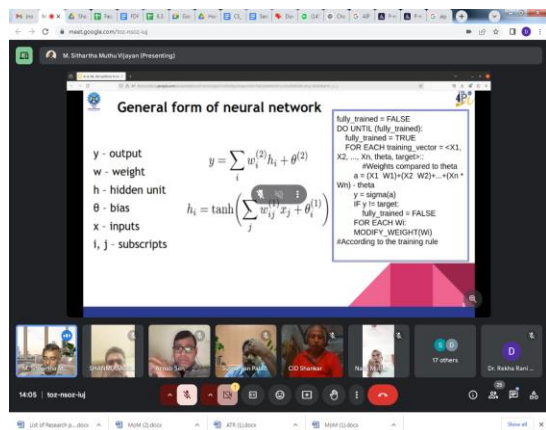
**Resource Person: Dr.M.SITHARTHA MUTHU VIJAYAN**

**Resource Topic: AI & ML disruptions in teaching Physical Sciences**

Dr. M. Sithartha Muthu Vijayan delivered a session on "AI & ML Disruptions in Teaching Physical Sciences," where he explored how AI and ML are transforming education. Key disruptions include personalized learning, with AI-driven platforms adapting content to individual student needs, and real-time feedback that helps students address weaknesses. Data-driven insights, through analytics and predictive models, allow educators to improve teaching strategies and intervene with at-risk students. AI-powered simulations and gamification enhance engagement, while intelligent tutoring systems and online platforms broaden access to resources.

Challenges include the digital divide, which may worsen inequality, and concerns over data privacy, requiring strict guidelines. Teachers must be trained to integrate AI tools effectively, and there's a risk of over-dependence on technology, potentially limiting critical thinking. Future trends in education include AI-enhanced curriculum development, fostering collaboration through AI, immersive learning with VR/AR, and continuous assessment systems that track student progress.

In conclusion, AI and ML offer significant potential for personalized education and interactive learning, despite challenges. Institutions must invest in infrastructure, teacher training, and ethical guidelines to protect student data. Research on AI's effectiveness in physical sciences education should be encouraged to improve outcomes.



**Date: 05.10.2024**

**Time: 11.30 a.m to 1.00 p.m and 3.30 pm to 5.00 pm**

**Resource Person: Dr.P.KALIMUTHU**

**Resource Topic: Solar Water Splitting**

With the growing threat of climate change and the depletion of fossil fuels, the need for alternative energy sources is urgent. Hydrogen, produced through renewable methods like solar water splitting, offers a promising solution. Solar water splitting utilizes solar energy to drive the conversion of water into hydrogen and oxygen gases, providing a clean and sustainable method for hydrogen production. The mechanisms involved include photo catalysis, photo electrochemical (PEC) cells, and thermochemical water splitting. Future technologies focus on advancements in photo catalytic systems and PEC cells. However, challenges such as efficiency, stability, durability, and economic viability need to be addressed. While significant obstacles remain, solar water splitting offers a viable pathway towards sustainable hydrogen production. Ongoing research and technological advancements are expected to unlock more efficient and economically feasible systems in the future, contributing to global energy stability.

**Date: 07.10.2024**

**Time: 10.00 am to 11.30 am**

**Resource Person: Dr.K.P.ELANGO**

**Resource Topic: Prevalence of Fluoride and its Optical Sensing**

The Resource Person has explained in first session in the topic “**Prevalence of Fluoride and its Optical Sensing**”. Biological significance of anions play a major role in environment, the admissible level of fluoride in drinking water is 1.5 mg / liter, if it is more than that, leads to fluorosis diseases like dental fluorosis, skeletal fluorosis etc.,. How to detect the fluorides using the zirconium lake of alizarin and visual detection method to identify fluoride ion also illustrated. Then he concluded that, despite large number of different sensors studied, we need receptors with selectivity, sensitivity and adoptability to practical applications when sensing in water is considered.

**Date: 06.10.2024**

On 06.10.2024 at 4.00 pm the MCQ Test-1 was conducted by online mode. At the end the test at 4.30 pm the participants have completed their MCQ Test-1 and submitted by the Google form link.

**Date: 07.10.2024**

**Time: 11.30 a.m to 1.00 p.m**

**Resource Person: Dr.N.DHARMARAJ**

**Resource Topic: Nano fibers by electrospinning: New category of materials with potential biomedical application.**

The electrospinning method produces micro- or nanofibers by applying high voltage to a liquid solution, which forms a jet that dries and deposits fibers on a collector. This technique creates nonwoven webs of nanofibers suited for a wide range of biomedical and technological applications. These include smart mats, filtration membranes, tissue engineering, and catalytic supports. In energy-related fields, nanofibers are used for energy harvesting, conversion, and

storage components, as well as in photonic and electronic devices. Biomedical uses include scaffolds, biotechnology, biosensors, drug delivery systems, wound healing, regenerative medicine, and implantable devices.

**Date: 07.10.2024**

**Time: 2.00 p.m to 3.30 p.m**

**Resource Person: Dr.K.P.ELANGO**

**Resource Topic: Small molecules as Anion Sensors.**

The Resource Person in second session gave an illustrative talk on “**Small molecules as Anion Sensors**”. He started with different types of anion sensor and explained about, why cyanide is poison, what are the symptoms of poisoning and its mechanism and antidotes to cyanides. Basic sensor mechanism like chemidosimetric etc., colorimetric detection of Cyanide ion also discussed. Professor gave an illustrative talk with variety of molecules for sensing applications.

**Date: 07.10.2024**

**Time: 3.30 p.m to 5.00 p.m**

**Resource Person: Dr.N.DHARMARAJ**

**Resource Topic: Metallo drugs and Diagnostic Agents: From Historical Practices to Current Trends**

Metallo drugs are commonly used for anti-inflammatory, antiviral, antibacterial, and anticancer purposes. Salvarsan, a pioneering arsenic-based antibacterial drug developed by Paul Ehrlich, was among the first medicinal metallo drugs. Most metal drugs are metal complexes, with organometallic drugs featuring direct metal-carbon bonds. Cyanide-based inorganic metal drugs are currently in use for cancer treatment. Diagnostic agents, which react specifically with certain chemicals, play a crucial role in clinical pathology and other medical sciences, helping to determine both the cause and nature of diseases. These agents assist in both qualitative and quantitative analysis. The session concluded with a vote of thanks by Dr. S. Sivasankaran at 5 pm.

**Date: 08.10.2024**

**Time: 10.00 a.m to 1.00 p.m**

**Resource Person: Dr.B.SUNDARAKANNAN**

**Resource Topics: 1. Bulk Ferroelectric Photovoltaics  
2. Dielectric Energy Storage Materials**

Energy demand is rising, leading to a need for efficient energy generation and storage materials. Ferroelectric materials are promising for both energy harvesting and storage, with two key applications: bulk ferroelectric photovoltaics and dielectric energy storage materials.

Bulk ferroelectric photovoltaics utilize the bulk photovoltaic effect (BPVE), where intrinsic polarization separates charge carriers, potentially overcoming the Shockley-Queisser limit of conventional solar cells. These materials can generate higher voltages than the bandgap but face challenges like wide bandgaps and complex synthesis processes.

Dielectric energy storage materials, used in capacitors, store energy through polarization. The energy density depends on the dielectric constant and breakdown strength. Linear dielectrics, like  $\text{SiO}_2$ , are common in electronics, while ferroelectric dielectrics, like  $\text{BaTiO}_3$ , offer higher energy storage but suffer from fatigue. Though dielectric materials are crucial for short-term energy storage in electronics and renewable systems, research continues to improve their energy density and long-term stability.

**Date: 08.10.2024**

**Time: 2.00 p.m to 4.30 p.m**

**Resource Person: Dr.S.NAGARAJAN**

**Resource Topics: 1.Organic Electronics  
2. Single Molecule Experiments**

On the last day of the Interdisciplinary Refresher Course in Physical Sciences, organized by UGC-Malaviya Mission Teacher Training Centre at The Gandhigram Rural Institute-DTBU, Prof. Dr. S. Nagarajan, Dean Academics, Central University of Tamilnadu, was the invited speaker. Dr. D. Nallamuthu introduced the speaker and delivered the welcome address. The session was divided into two topics.

The first topic, "Organic Electronics," discussed electronic materials, including conductors, insulators, semiconductors, and their applications, with a focus on the importance of organic electronics and paper electronic devices. Prof. Nagarajan also explained the design strategies for semiconducting materials.

The second part focused on "Single Molecule Experiments," explaining the size, handling, and reasons for studying single molecules, along with emerging research trends and applications.

The lecture concluded with an interactive Q&A session. Dr. P. Sutharsan delivered the vote of thanks, expressing gratitude to the speaker and the organizing team for their efforts in successfully conducting the course.

### **Valedictory Function**

Last day of the Online Interdisciplinary Refresher Course in Physical Sciences programme ended on 8<sup>th</sup> October, 2024 4.30 pm with presided by the Registrar i/c, GRI, Gandhigram. Dr. G. Muralidharan, Senior Professor, Dept. of Physics, GRI delivered the Valedictory Address and Dr. A.



Jahitha Begum HOD & Senior Professor who elaborated the Special Address. K. Marimuthu Professor, Department of Physics & Programme Coordinator in which he highlighted the Report of the entire session of the programme. Dr. P.S. Sreedevi, Programme Director, UGC-MMTTC,GRI Proposed vote of thanks of the programme.

On 08.10.2024 at 7.00 pm the MCQ Test-2 was conducted through online mode. At the end the test at 7.30 pm the participants have completed their MCQ Test-2 by the Google form link.