

A Brief Report on Nano Technology & Its Applications (An Industry & Institute Partnership Program)

April 26-30, 2021



Organised By



RAJIV GANDHI NATIONAL INSTITUTE OF YOUTH DEVELOPMENT

Institution of National Importance by the Act of Parliament No.35/12

Ministry of Youth Affairs and Sports,

Government of India, Sriperumbudur – 602 105

IN ASSOCIATION WITH


 <p>NATIONAL INSTITUTE OF TECHNOLOGY, JALANDHAR Institute of National Importance under the Act of Parliament – 2007 Ministry of Human Resource Development, Government of India Jalandhar, Punjab - 144 011</p>	 <p>NATIONAL INSTITUTE OF TECHNOLOGY, TRICHY Institute of National Importance under the Act of Parliament – 2007 Ministry of Human Resource Development, Government of India Trichirapalli-620015</p>	 <p>JAWAHARLAL NEHRU UNIVERSITY New Delhi 110067</p>	 <p>Seagate Technology & Boston Scientific MINNESOTA, USA (Industry Partner)</p>
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Preface and Acknowledgements


As a sequel to various technical training programmes being imparted by RGNIYD for the underprivileged youth across the country on various information technology related skills, the sixth in the sequence was the Short-term Certificate Course on Nano Technology and Its Applications held from April 26-30, 2021 through online mode. The most sought after course was offered by RGNIYD as an Institution – Industry Partnership programme in collaboration with the NIT-Jalandhar, NIT-Tiruchirapalli, Special Centre for Nano Sciences, Jawaharlal Nehru University, Delhi, Seagate Technology, USA and Boston Scientific, USA.

The collaborations with these illustrious institutions and industries enhanced the quality and standard of the course for which RGNIYD is ever thankful. The Heads of these institutions and professionals from these industries have provided utmost support in offering this programme and have deployed their best faculty and experts to serve as resource persons.

The programme included sessions which are more application oriented in the field of nano technology across various sectors including research and medicine. The speciality of this particular course was to provide the participants, hands on technical and transferrable skills in the demand driven field of nano technology.

I wish to thank the Heads of the Collaborating Institutions Prof.Lalit Kumar Awasthi, Director, NIT, Jalandhar and Prof. Mini Shaji Thomas, Director, NIT, Tiruchirapalli, Prof. Bijoy Kumar Kuanr, Chairperson, Special Center for Nano Sciences, Jawarhalal Nehru University, New Delhi for partnering with RGNIYD for offering this course and in particular, Dr.V.Veera Kumar, Former Scientist, R&D, Seagate and Engineering Manager, Boston Scientific, Arden Hills, Minnesota for connecting RGNIYD with Seagate Technology and Boston Scientific both located at USA and for identifying industry experts in the US to deliver lectures during this programme.

I take this opportunity to profusely thank Shri. Kiren Rijiju Ji, the Minister of State (Independent Charge) for Youth Affairs and Sports, Government of India, Smt. Usha Sharma, IAS, Secretary to the Government of India, Department of Youth Affairs, Ministry of Youth Affairs and Sports, Government of India, Shri. Asit Singh, IRS Joint, Secretary to the Government of India, Department of Youth Affairs, Ministry of Youth Affairs and Sports, Government of India and Shri. Majoj Sethi, ICAS, Joint Secretary and Financial Advisor to the Government of India, Ministry of Youth Affairs and Sports, Government of India for being a great source of strength and support to RGNIYD.



I would like to extend my sincere thanks to Prof. S. K. Sinha, Dean, NIT, Jalandhar, Dr. S. Muthukumaran, Dean, R & C, NIT Tiruchirapalli and Prof. K. S. Ravichandran, Registrar, RGNIYD for all their contributions in rolling out this course. The Resource Persons of the course deserve special appreciation for their passionate resource support and for delivering expert lectures during the course.

The team at RGNIYD which include Dr. P. Muralidassan, Consultant-Administration, Shri. Agilan, Assistant Registrar, Shri. P. David Paul, Training Officer, Shri. Ramkumar, Technical Officer and Shri. Balakrishnan, Programmer for their continued support for running this certificate course.

I would like to finally thank all officials and personnel of our collaborating Institutions and Industry for extending their support behind the backdrop for the smooth conduct of this programme.

RGNIYD is dedicated to strive for the cause of youth development in the country and we are working towards offering various such professionally rewarding programmes for the youth of the country for their career growth and economic development of the country.

PROF. SIBNATH DEB, PhD, DSc

Director,

Rajiv Gandhi National Institute of Youth Development

(An Institution of National Importance by Act of Parliament No.35/2012)

Ministry of Youth Affairs and Sports, Government of India, Sriperumbudur, Tamil Nadu – 602 105, India

Member, Board of Directors, Institute for School-based Family Counseling, California, USA

Adjunct Professor, School of Justice, Faculty of Law, Queensland Univ. of Technology, Brisbane, Australia.

Background

RGNIYD in the past has organised various specialized courses of contemporary relevance such as Cyber Security, Artificial Intelligence and Machine Learning, Advances in Data Science, Cloud Computing, Internet of Things besides organising lecture series by international experts from RWTH Aachen University, Germany.

In this series, the sixth course is on “**Nano Technology and Its Applications**”. The specialty of this course is that leading educational institutions of higher learning viz., NIT Jalandhar, NIT Tiruchirapalli, Special Centre for Nano Sciences, Jawaharlal Nehru University, New Delhi have converged along with the prominent industry - Seagate Technology, USA and Boston Scientific, USA to offer this course. These youth development initiatives which are of paramount significance to advance the skill-set of today’s youth was spearheaded by RGNIYD with the support of these partnering organizations. This is yet another initiative of the Government of India towards building the skills of youth thereby providing a good direction for widening their horizon of youth employment.

Introduction


Imparting Education and Skill Development is of paramount significance to the Department of Youth Affairs, Ministry of Youth Affairs and Sports, Government of India as well as the imperative mandate of Rajiv Gandhi National Institute of Youth Development (RGNIYD), an Institution of National Importance by an Act of Parliament and functioning under the Ministry of Youth Affairs and Sports, located at Sriperumbudur, Tamil Nadu.

During the unforeseen and unprecedented second wave of the COVID-19 Pandemic, all the educational and training institutions have been required to shut down their operations across the world, particularly in India with the rising number of infected persons, more so, among the young people during this second consecutive year.

While the infections are on the rise, it is unjust to remain silent when the young people are deprived of various educational and skill development avenues. Therefore, RGNIYD during the continued to offer its flagship technical training courses and short-term job oriented certificate programmes of contemporary and futuristic relevance that will prepare the youngsters to embark on lucrative and sustainable careers.

As a sequel to the earlier short-term certificate courses on Cyber Security, Artificial Intelligence and Machine Learning, Recent Advances in Data Sciences and Cloud Computing, and Internet of Things and Automation RGNIYD designed another innovative course on Nano Technology and Its Applications which is poised to drive the entire world in the near future.

In order to bring in a synergy between educational institutions and leading industries, the programme was organised as an Industry-Institution Partnership programme for which RGNIYD collaborated with leading technological institutions in the country, viz., the National Institute of Technology - Jalandhar, Punjab, the National Institute of Technology – Tiruchirapalli, Tamil



Nadu both the organizations being Institutions of National Importance under the Act of Parliament – 2007 and functioning under the Ministry of Human Resource Development, Government of India and with Seagate Technologies and Boston Scientific both located in Minnesota, USA. With these collaborating institutions, the Five-day Short-term Online Certificate Course on Nano Technology and Its Applications from April 26-30, 2021 through Cisco Webex Platform.

The Short-term Certificate course was thoughtfully designed and delivered as an Institution-Industry-Partnership-Programme in consonance with the priorities enshrined in the New National Education Policy, 2020 and the Revised National Youth Policy, 2021.

The Resource Persons from the collaborating institutions and industry facilitated various sessions during this short-term and delivered content in a scintillating manner with simple teaching methodologies to overcome the barriers of online teaching.


About the Nano Technology Course

This programme dealt with the emerging technology which is Nanotechnology that influences almost every facet of everyday life from security to medicine. The concept of nanotechnology is that when one goes down to the bottom of things, one can discover unlimited possibilities and potential of the basic particle. In nanotechnology, analysis can be made to the level of manipulating atoms, molecules and chemical bonds between them.

Nanotechnology or nanoscience refers to research and development of an applied science at the atomic or molecular level (i.e. molecular engineering, manufacturing). The word “nano” derives from the Greek word which stands for “dwarf”. Nanoscale though small in size has vast potential. One nanometer is 1 billionth or 10^{-9} of a meter. The comparative size of a nanometer to a meter is the same as the size of a marble to the size of the earth.

The basic idea of nanotechnology is to employ individual atoms and molecules to construct functional structures. Nanotechnology can be applied to various medical fields like Pharmacological research, clinical diagnosis, supplementing immune system, cryogenic storage of biological tissues, detection of proteins, probing of DNA structure, tissue engineering, tumor destruction via heating (hyperthermia) separation and purification of biological molecules and cells, magnetic resonance imaging (MRI) contrast enhancement, etc.

The various nanoparticles include nanopores, nanotubes, quantum dots, nanoshells, nanospheres, nanowires, nanocapsules, dendrimers, nanorods, liposomes and so on. More recently, tiny machines called nano-assemblers that could be controlled by computer to perform specialized jobs have been invented. These nano-assemblers could be smaller than a cell nucleus so that they fit into places that are hard to reach by hand or with any other technology. It can be used to destroy bacteria in the mouth that cause dental caries or even repair spots on the teeth where decay has set in by the use of computers to direct these tiny workers in their tasks.



The ongoing quest for miniaturization has resulted in tools like the atomic force microscope and the scanning tunneling microscope. Combined with refined processes such as electron beam lithography, these instruments allow researchers to deliberately manipulate and manufacture nanostructures; something they couldn't do before.

Engineered nano-materials, either by way of a top-down approach (a bulk material is reduced in size to nano-scale patterns) or a bottom-up approach (larger structures are built or grown atom by atom or molecule by molecule), go beyond just a further step in miniaturization. They have broken a size barrier below which quantization of energy for the electrons in solids becomes relevant.

The so-called quantum size effect describes the physics of electron properties in solids with great reductions in particle size. This effect does not come into play by going from macro to micro dimensions. However, it becomes dominant when the lower nanometer size range is reached. Materials reduced to the nano-scale can suddenly show very different properties compared to what they show on a macro-scale. For instance, opaque substances become transparent (copper); inert materials become catalysts (platinum); stable materials turn combustible (aluminum); solids turn into liquids at room temperature (gold); insulators become conductors (silicon).

A second important aspect of the nano-scale is that the smaller a nano-particle gets, the larger its relative surface area becomes. Its electronic structure changes dramatically. Both effects lead to greatly improved catalytic activity but can also lead to aggressive chemical reactivity.

The fascinating prospects that nanotechnology offers engineers and researchers stems from these unique quantum and surface phenomena that matter exhibits at the nano-scale, making possible novel materials and revolutionary applications.


As this is relatively a booming field which has potential scope for employment to the youth, RGNIYD organized this course in collaboration with the best technological institutions in the country and globally acclaimed industries in the field.

Rationale

RGNIYD is collaborating with the premier Technological Institutes in India and internationally reputed Industries for conduct of short-term certificate course on Nano Technology and its Applications to prepare the youth to secure more job opportunities and enhance their employability skills.

The application of nano technology cuts across varied fields such as Textiles, Biomedical, Health Care, Food Agriculture, Industrial, Electronics, Environment, renewal Energy etc., providing a plethora of career opportunities for the teeming youth aspiring to specialize in this field. Such initiatives collectively contribute towards skilling our young people and providing them avenues for sustainable careers.

Though the course is offered free of charge, a lot of investment is being made in terms of financial resources from the Government, time and energy of the partnering institutions for



designing, delivering and upgrading the skills of the participants. Therefore, it is not to be undermined in terms of the course design, content and the resource persons. The course has been carefully built in with appropriate technical sessions to provide a complete conceptual understanding of the nano technology field and its applications by illustrious resource persons of national and international acclaim.

Objectives

This present course has been designed in alignment with the recent developments in the field and the industrial requirement globally suitable to the employment situation. The objectives of the course were to:

- Provide the participants an overview of Nano Technology
- Familiarize the participants on the application value of Nano Technology
- Raise awareness on the contemporary scope of this field in the world of work
- Enhance the competencies of the youth in Nano Technology field
- Preparing the youth to become employment ready to embark on futuristic sustainable careers
- Proliferating the chances for sustained employment among young people

Collaborating Institutions

The programme was organised as an Institution – Industry Partnership Course in association with National Institute of Technology, Tiruchirappalli, National Institute of Technology, Jalandhar, Special Centre for Nano Sciences, Jawaharlal Nehru University, New Delhi, Seagate Technology, Minnesota, USA and Boston Scientific, Minnesota USA.

Distinctiveness

The sessions were facilitated by Resource Persons of very high stature in the field from NIT Tiruchirappalli, NIT Jalandhar, JNU, Seagate Technology, USA and Boston Scientific, USA.

Expected Outcome

The present course intended to familiarize the participants on the basic concepts of Nano Technology and its Applications. This programme also sought to widen the career horizons for young people who wish to enter or advance their careers in this exciting and well-paying field or to enhance their learning for a higher technology role. Further, the programme was expected to provide a platform for interaction of youth with the professionals in teaching and practice to provide guidance and direction for the participants to pursue education and career in this specialized field.

Participants

The programme is being offered for the youth who hail from science, computer and information technology backgrounds pursuing their educational programmes or those who have completed their educational programmes and looking for employment opportunities.

A total of 811 candidates registered for the course however, 528 student youth across the country drawn from various NITs, IITs, illustrious technological institutions, colleges and universities attended the course. Among the participants who had over 70% of attendance, 325 candidates were provided certificates.

Inaugural Session



The Online Short-term Certificate Programme on **Nano Technology and its Applications** was inaugurated on April 26, 2021 online. Prof. Sibnath Deb, Director, RGNIYD, Ministry of Youth Affairs and Sports, Government of India welcomed the guests and participants and provided a brief introduction to the course and its coverage.



Later, Prof. Lalit Kumar Awasthi, Director, NIT, Jalandhar, Prof. Mini Shaji Thomas, Director, NIT, Tiruchirapalli, Dr. V. Veera Kumar, Former Scientist, R&D, Seagate and Engineering Manager, Boston Scientific, Arden Hills, Minnesota, USA, and Prof. Bijoy Kumar Kuanr, Chairperson, Special Center for Nano Sciences, Jawarhalal Nehru University, New Delhi addressed the participants.

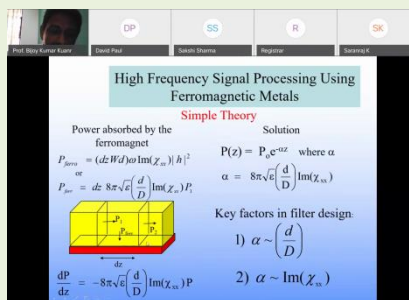
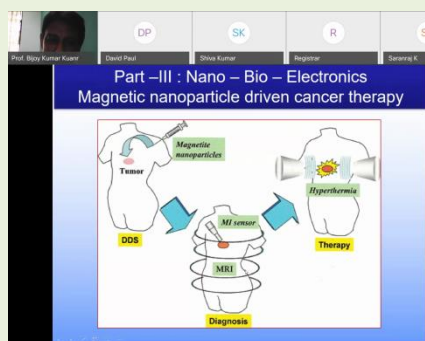


The Registrar, RGNIYD Prof. K. S. Ravichandran proposed the formal vote of thanks.

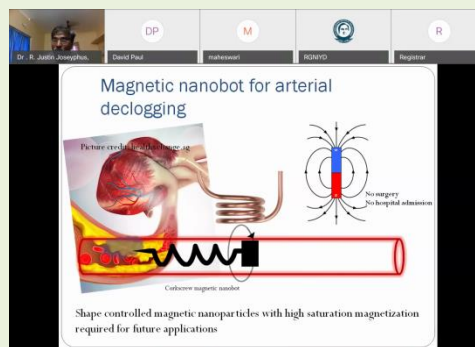
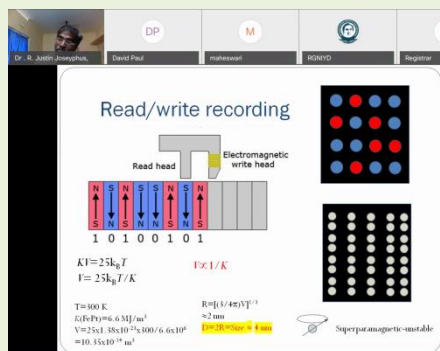
Proceedings of the Technical Sessions

Day – 1

On the first day (April 26, 2021), the first session was handled by Prof. Bijoy Kumar Kuanr, Chairperson, Special Center for Nano Sciences, Jawarhalal Nehru University, New Delhi on the topic “Nano Technology and its Applications”. The initial session provided an overview and conceptual understanding on nano technology and the broad areas of applications and the future prospects of the subject were discussed at length.

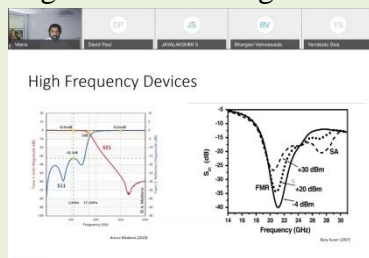


The second session on the first day was handled by Dr. R. Justin Joseyphus, Associate Professor, Department of Physics, National Institute of Technology, Tiruchirappalli on the topic “Emerging Applications of Magnetic Nanoparticles” on April 26, 2021. The session was insightful and multidisciplinary in nature and the participants were able to grasp the topics discussed easily due to the illustrations provided. At the end of the session, the resource persons clarified the doubts of the participants.

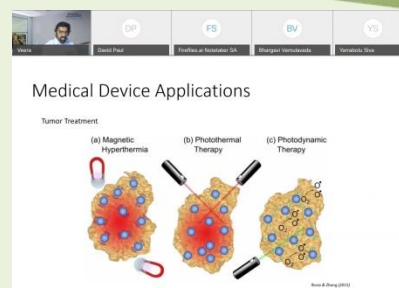


Day – 2

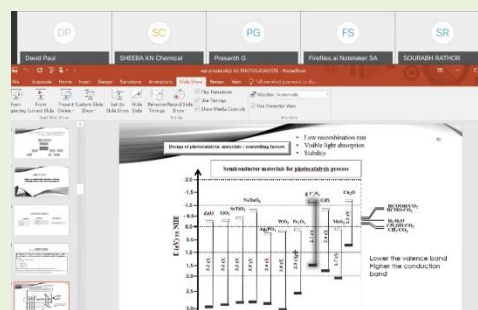
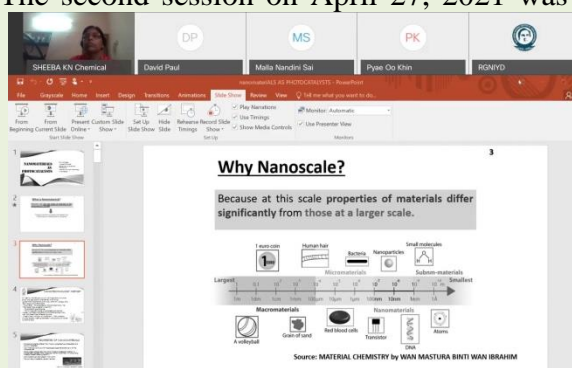
On the second day (April 27, 2021) the first session was handled by Dr. V. Veerakumar from the Center for Magnetism and Magnetic Nanostructures, Department of Physics, University of Colorado, Colorado Springs, Colorado, USA. He spoke on “Nanotechnology for High Frequency and Medical Device Applications”. He introduced the industrial application values of



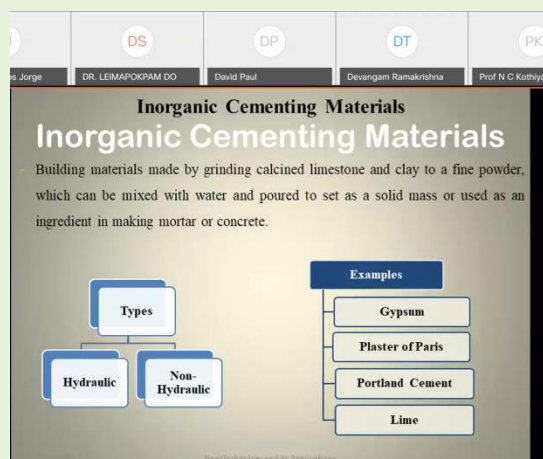
nano technology and how this technology is increasingly growing, particularly in the health and medical sectors. He detailed about the functional utility of nano technology in neuromodulation, cardiac rhythm management, electrophysiology, interventional cardiology, peripheral interventions for treatment of peripheral vascular diseases and cancer, endoscopy, urology and pelvic health. He further detailed about the high frequency devices employing nano technology . He in particular explained the medical device applications, especially, the application value in tumor treatment which included magnetic hyperthermia, photothermal therapy and photodynamic therapy.



The second session on April 27, 2021 was handled by Dr. K. N. Sheeba, Associate Professor Department of Chemical Engineering National Institute of Technology Tiruchirappalli, on the topic “Nanomaterials as Photocatalysts”. In her lecture she explained the need for nanoscale and how the scale properties of materials differ significantly from those at a larger scale citing the examples of euro coin, human hair, bacteria, small molecules, macro-materials and nanomaterials. She further detailed the design of photocatalytic material and their controlling factors. She elaborated on semiconductor materials for photo-catalysis and how nano-materials act as photocatalysts citing various applications.



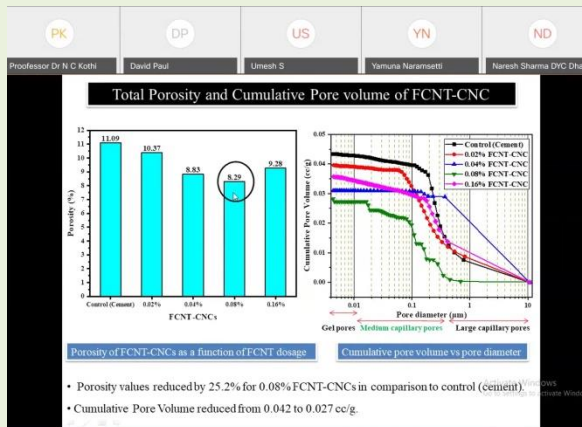
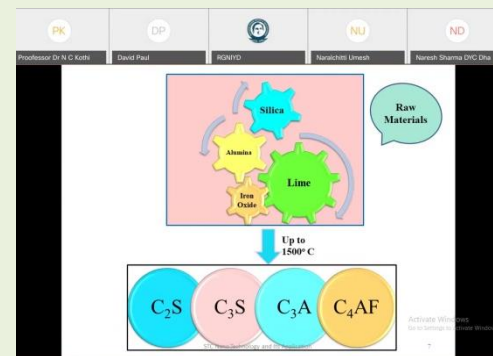
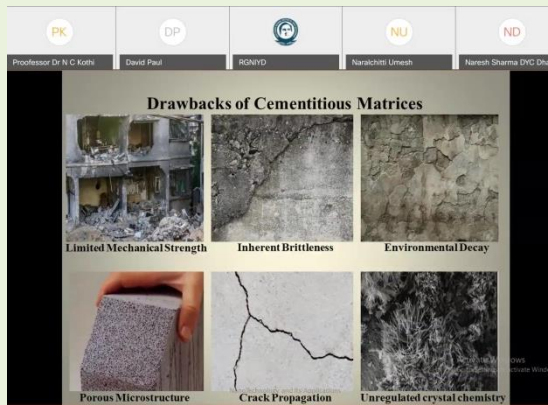
Dr. N. C. Kothiyal, Professor and Head, Department of Chemistry, NIT-Jalandhar, Punjab handled the third session on April 27, 2021 on the topic “Carbon Nanomaterials and their role in Improving physico chemical Properties of Cement Matrix for Civil Engineering Applications”. During his session he explained that cement mortar is a prominent construction material worldwide and is the basis of a range of civil engineering infrastructures. He mentioned that the inorganic cementing material is prone to several limitations such as low physico-mechanical strength, quasi brittleness, cracking phenomenon, high permeability, and porous microstructural features. He illustrated that nanotechnology has emerged as a promising approach for the utilization of nano-sized reinforcements in cement-based materials. Carbon Nanomaterials (CNs) such as 1-D Carbon Nanotubes (CNTs) and 2-D Graphene Oxide (GO)



possess extraordinary mechanical properties. Owing to their high surface area, high aspect ratio, and excellent mechanical properties, carbon nanomaterials provide extra dimensions at the interface to interact with the cementitious matrix. In spite of these advantages, there are few limitations to their use in the cementitious matrix, such as poor dispersion of CNs in the alkaline cement pore solution. He explained the possible ways to enhance the dispersion of carbon nanomaterials which could be the covalent functionalization of CNs or the dispersion of the CNs by superplasticizer. He further detailed another method that can be opted which is the utilization of hybrid carbon nanomaterials as nano-reinforcements (i.e., FCNTs and GO) in the cementitious matrix to envisage their synergistic effect.

Additionally, the utilization of supplementary cementitious materials (SCMs) as partial replacement of cement in the cement mortars to reduce the cost has been considered in the current investigation was also discussed. The production of cement leads to the emission of a large amount of anthropogenic CO₂, a greenhouse gas. The utilization of SCMs could minimize cement use, thereby indirectly reducing the CO₂ emissions from cement industries. Also, a large amount of fly ash ending up in the landfills can be used as SCMs, to produce sustainable and economical construction material.

He cited that his research studied the influence of CNs and HCNs as reinforcing phases in improving the physico-mechanical strength of Cementitious Nanocomposites (CNCs) and Fly Ash blended Cementitious Nanocomposites (FCNCs). Different carbon nanomaterials were incorporated into the CNCs and FCNCs were Functionalized Carbon Nanotubes (FCNTs), Graphene Oxide (GO), and Hybrid of FCNTs & GO (i.e., HCNs). The improved dispersion of the HCNs in comparison to FCNTs or GO was monitored by UV-Visible Spectroscopy. The influence of CNs and HCNs on the compressive and tensile strength of the CNCs and FCNCs were evaluated for the dosages of carbon nanomaterials ranging from 0.02% to 0.16% (by weight of cement/blend). Other properties of the CNCs and FCNCs studied were microstructural studies, crystalline behavior, porosity, and electrical resistivity of the CNCs and FCNCs. These properties were studied as a function of the CN/HCNs dosages and the curing time (7, 14, 28 and 90 days). He mentioned that the results obtained through his study showed that higher enhancement in the physico-mechanical strength



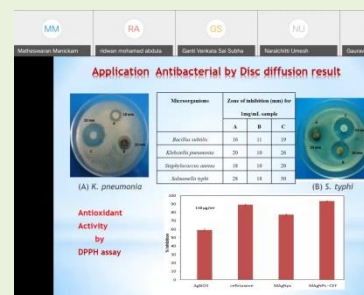
has been caused by HCNs as compared to individual CNs (i.e., FCNTs or GO). The maximum compressive strength values were found for 0.02% HCN-CNCs and 0.16% HCN-FCNCs by 43.08% and 52.10%, respectively. On the other hand, the maximum tensile strength values were found for 0.08% HCN-CNCs and 0.08% HCN-FCNCs by 52.20% and 64.35%, respectively, in comparison to control samples at 90 days of curing. He further explained that improvement in the hydration reactions of CN/HCNs incorporated CNCs and FCNCs was accessed with the help of microstructural and crystalline studies. He mentioned that the increased compactness and pore structure refinement of the cement matrix has also been supported by the Electrical Resistivity and Mercury Intrusion Porosimetry (MIP) studies.

Day – 3

Dr. Sangita Kalarickal, Senior Staff Engineer, Data Analytics and Modeling, Seagate Research Group, Shakopee, Minnesota, USA delivered the first lecture on April 28, 2021 on the topic “Heat Assisted Magnetic Recording - The Future of Information Storage Part – I”. She initially introduced to the participants about the work activities of Seagate Technology and the kind of products their industry manufacture besides explaining the Seagate's global presence.

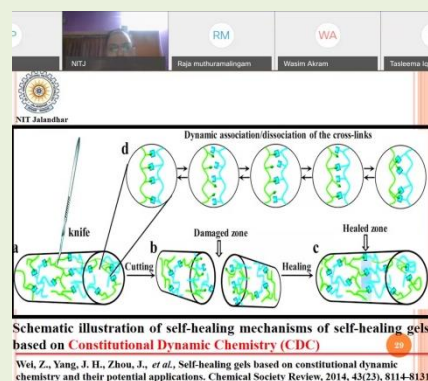
She further dealt at length the means of storing digital information on a disk drive and how Seagate harnessed nano technology for manufacturing digital storage devices and the underlying processes and mechanisms of manufacturing a range of storage devices were detailed at length. The specific application role of nano technology was articulated at length.

The second lecture on April 28, 2021 was delivered by Dr. M. Matheswaran Associate Professor, Department of Chemical Engineering National Institute of Technology – Tiruchirappalli on the topic “Scope of Nanomaterials for Environmental Applications”. In his lecture he explained how nanomaterials could be used for environmental applications and preservation of environmental and natural resources. He further explained the process of making nanostructures, application antibacterial by disc diffusion process and the antioxidant activity by DPPH assay that underlies nano technology.

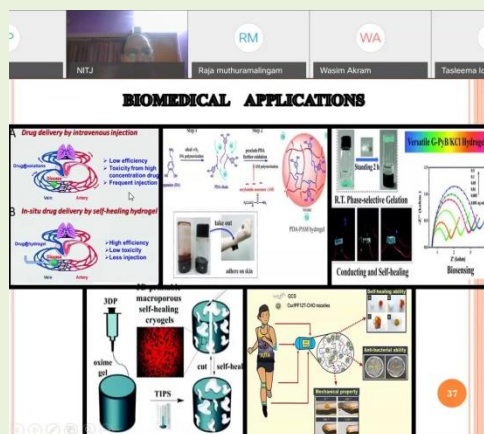


The third session on April 28, 2021 was handled by Dr. Balbir Singh Kaith, Professor, Department of Chemistry, Dr. B. R. Ambedkar National Institute of Technology, Jalandhar,

Punjab on the topic “Designing of Eco-Friendly Interpenetrating Smart Materials – Applications in Different Fields”. In this session he detailed about the materials which respond to environmental change which are called “Smart materials.” They are temperature, pH, light, magnetic or electric field and ionic factors sensitive biological molecules. Such materials are environmental stimuli responding materials. They are 3-D polymeric network systems and consist of hydrophilic cross-linked macromolecules. 3-D network is responsible for absorbing and retaining large quantities of water or any other fluid. The major applications of such materials are in the fields like multi-functional smart clothing, energy storage, tissue stimulants, armor, sensors and electronic devices, robotics, responsive coatings and battlefield medicine.

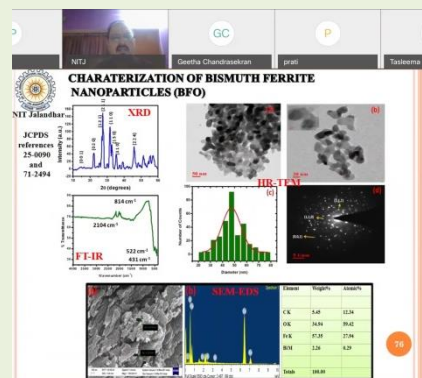


These materials have the characteristics to minimize scarring, strengthening of new tissue, providing proteins for healing, absorption of fluids from inflammation sites, blocking of nerve endings to reduce pain, encouraging of natural blood clotting, forming of barrier against infection and providing scaffold for cell growth.



Moreover, such materials can be used for the sustained and controlled release of fertilizers and pesticides. Such technologies can provide alternative to traditional chemical fertilizer treatment due to their ability to release the

agrochemicals and water content to the soil in a slow and sustained way. This results in maximum crop yield. Controlled release technique also reduces the air and underground water pollution. The overdoses of fertilizers and pesticides can be controlled with this technique to facilitate the farmers with the problem of increasing fertilizer and pesticide cost. Thus, the multifunctional smart materials provide a better way to solve problems related with agricultural issues.

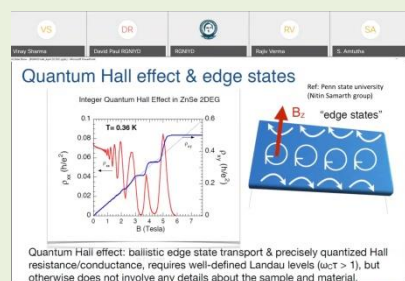


In his lecture the preparation of multifunctional smart polymeric materials of natural origin and their applications in biomedical, pharmaceuticals, textile industries and agriculture were highlighted. Synthesis of nanomaterials using polymeric templates were also covered during his lecture.

Day – 4

The first session on April 29, 2021 was handled by Dr. Vinay Sharma, Post-Doctoral Researcher, Morgan State University, Baltimore, Maryland, USA on the topic “Nano Heterotstructures for RF Applications”. His lecture included detailed discussions on

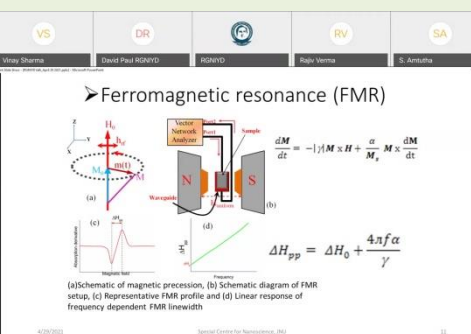
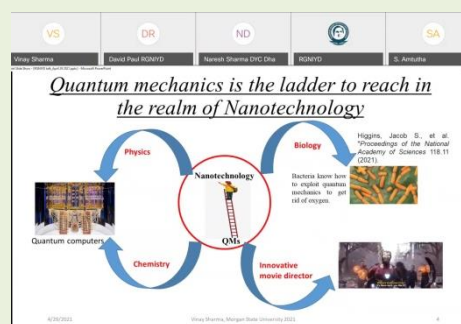
heterostructures and how these structures can be utilized for RF applications. Citing various studies that he conducted, he explained nano-magnetism and its spintronic applications. In his session, he mentioned that quantum mechanics is the ladder to reach the realm of nano technology. He further explained the



quantum Hall Effect and edge states.

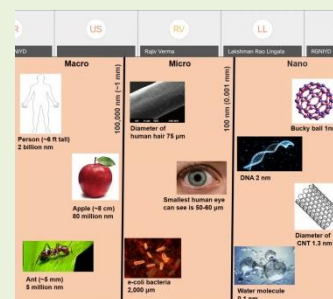
concepts and applications of

Ferromagnetic Resonance (FMR) and the techniques of magnetic precession and presented a profile of FMR besides explaining the linear responses of frequency dependent FMR. H also dealt with



The second session on April 29, 2021 was handled by Dr. Uma Shanker, Assistant Professor, Department of Chemistry, Dr B R Ambedkar National Institute of Technology-Jalandhar, Punjab delivered a session on the topic Green Synthesized Nanomaterials for Water Pollutants Removal” on April 29, 2021. The green chemistry together with nanotechnology gave rise to the green nanomaterials, which use clean, safe, cost-effective and environmental friendly synthetic strategies to prepare nanomaterials. Many

efforts have been expended to synthesize nanomaterials from renewable and locally available sources to decrease the amount of harmful chemicals, generating biodegradable waste that does not present toxicity to humans and to the environment. Green nanomaterials such as metal and metal oxides nanoparticles, nanoporous carbon, carbon quantum dots, carbon nanofibers, prepared through green protocols and biopolymer nanoderivatives including chitin, chitosan



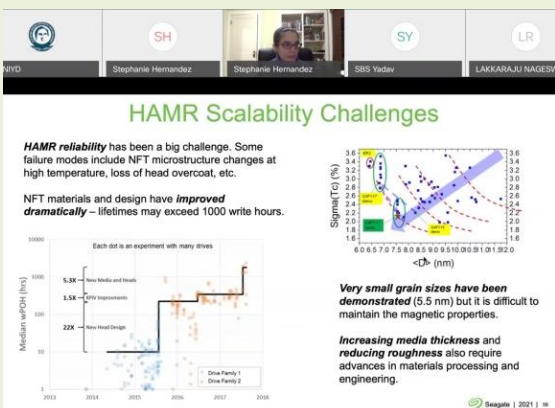
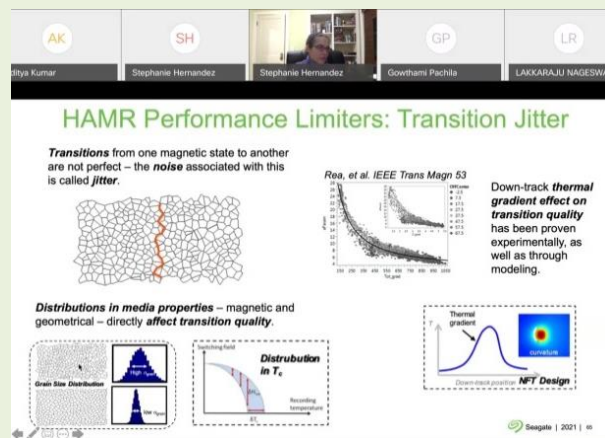
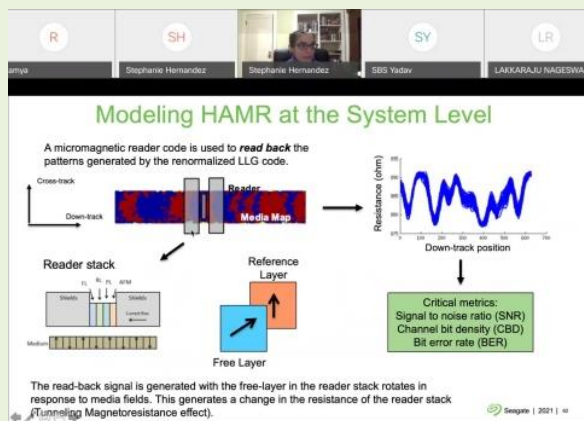
and cellulose are used to remove harmful gases, toxic metals, organic dyes, pharmaceuticals, pesticides and oils. The high surface area and the related reactivity of green nanomaterials enable their use with great efficiency in different processes, including sorption, filtration, stabilization, degradation, demulsification, flocculation and disinfection. This lecture was devoted to introduction of green synthesized nanomaterials as well as recent studies aiming at environmental remediation using sustainable nanomaterials designed based on the integration of the twelve principles of the green chemistry. Moreover, during the talk the resource person also discussed some real result of our laboratory studies in the removal of various water pollutants like organic dyes, phenols, polycyclic aromatic hydrocarbons and pesticides.

The third session on April 29, 2021 was handled by Dr. A. Chandra Bose Professor Department of Physics National Institute of Technology Tiruchirappalli, Tamil Nadu on the topic “Nano Materials for Energy and Environmental Applications”. During his lecture he detailed at length the different kinds of water pollutants, particularly synthetic in nature which can be effectively treated for removal of the pollutants using nano material. The session was highly enlightening as the lecture provided deeper insights into the application value of nano materials in conserving the environmental resources.

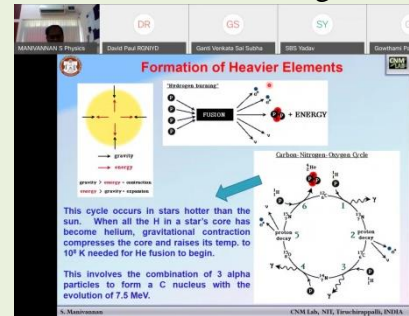


Day – 5

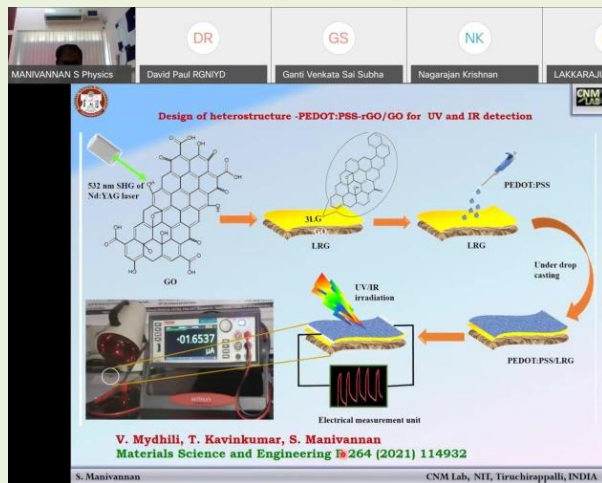
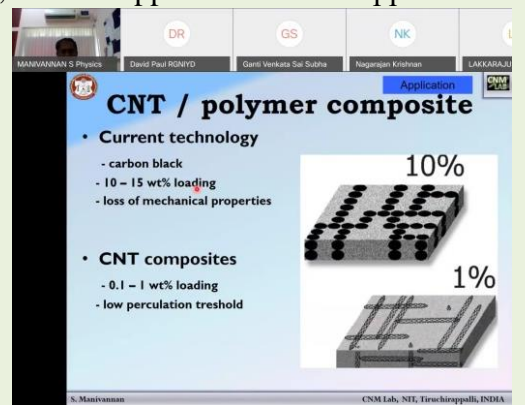
On the fifth and concluding day (April 30, 2021), the first session was handled by Dr. Stephanie Hernandez from Seagate Research Group, Shakopee, Minnesota, USA on the topic “Heat Assisted Magnetic Recording (HAMR) - The Future of Information Storage – II”. During her lecture she detailed her endeavours at Seagate in modelling advanced Heat Assisted Magnetic



Recording and further explained the System Modeling and Data Analysis for critical recording processes. She also explained various futuristic models and simulation tools used to design the hard drives. Later she detailed how the Heat Assisted Magnetic Recording (HAMR) – the near field transducer technology works to enhance the storage capacities of hard drives. She discussed at length the HAMR reliability issues, very small data gains to induce magnetic properties, NFT material and design, increasing media thickness and reducing roughness including modeling HAMR at the system level and HAMR performance limiters.



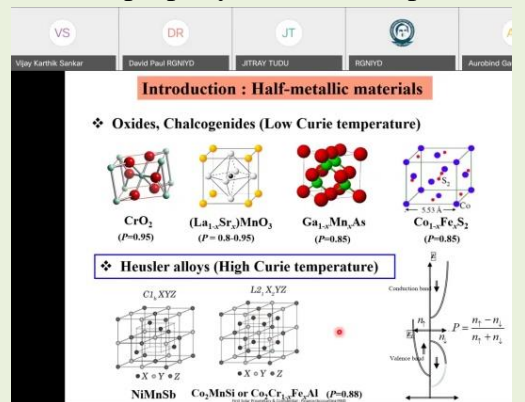
The second session on April 30, 2021 was facilitated by Dr. S. Manivannan, Associate Professor, Department of Physics, National Institute of Technology, Tiruchirappalli on “Nano Applications in Hardware Design”. He mentioned that carbon based nanomaterials such as carbon nanotubes (CNT), graphene, graphene oxide (GO), reduced graphene oxide (rGO), carbon dots, fullerene are considered as potential candidates in many hard-ware design including gas sensors, thin film transistors, display devices, field emitters, thin film heaters, transparent conducting films (TCF) as electrodes for solar cells and optoelectronics. Many challenges remain unanswered



in the

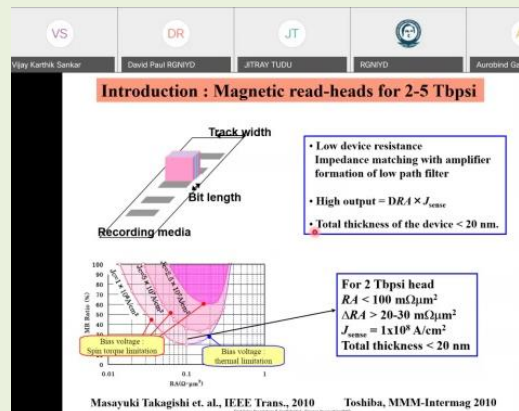
synthesize of pure and highly crystalline nanomaterials, methods involved in purification, tuning the properties through functionalization of carbon based nanomaterials, etc. Understanding the physio-chemical processes and characterization in each stages of materials treating and device fabrication is crucial in nanoscience and technology. In the present lecture, an introduction to nanoscale carbon materials, their bonding (sp , sp^2 and sp^3), structure and property relationship was

presented. Field emission properties of grown multi-walled carbon nanotubes and fabrication of portable X-ray tubes, TCF on glass and polymer substrates from single-walled carbon nanotubes, transparent thin film heaters from carbon nanotubes, fabrication of flexible and disposable gas sensor were deliberated in detail. In addition, a detailed study on the fabricated devices/components was displayed. Investigation on the microstructure and the dielectric properties of the prepared conducting polymer-GO/rGO-PVA composite was also explained. Opportunities and the challenges in



nanomaterials was provided at the end of his lecture.

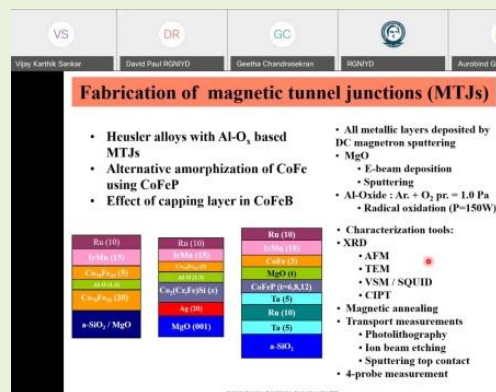
The third session on April 30, 2021 which was the final technical session of the 5-Day short-term



certificate course on nano technology and its applications was handled by Dr. Vijay Sankar, Former Researcher at Seagate Technology and currently working at First Solar Inc., Perrysburg, OH, USA on the topic “Nanofilms for Solar

Applications” during which he discussed at length on the nanostructured

devices for magnetic storage applications. During his session he explained about the magnetic read heads, half metallic material and the techniques involved in fabrication of magnetic tunnel junctions (MTJs).



Valedictory Session

The Five-Day Online Short-term Certificate Programme on Nano Technology and its Applications organised by the Rajiv Gandhi National Institute of Youth Development in collaboration with the National Institute of Technology, Jalandhar, National Institute of Technology, Tiruchirappalli, Special Centre for Nano Sciences, Jawaharlal Nehru University, New Delhi, Seagate Technology, Minnesota, USA and Boston Scientific, Minnesota USA from April 26 - 30, 2021 concluded on 30th April 2021.

During the valedictory session, the participants provided feedback on the course through which it was evident that the programme was immensely beneficial to the budding researchers and job aspirants in the area of nano technology.

Prof. Sibnath Deb, Director, RGNIYD, Ministry of Youth Affairs and Sports, Government of India delivered the valedictory address.

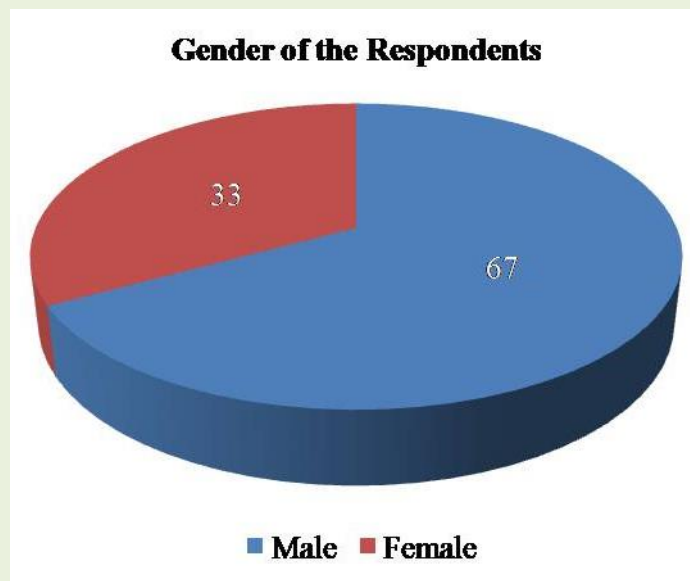
Evaluation of the Course

In order to evaluate the effectiveness of the online course in terms of its organization, content, delivery and other aspects, a semi-structured questionnaire was circulated among the participants on their e-mails in the form of Google Form. Among the participants, a total of 192 candidates provided feedback on the online certificate course. The following sections provide details about the feedback shared by the participants:

Section – 1: Background Information

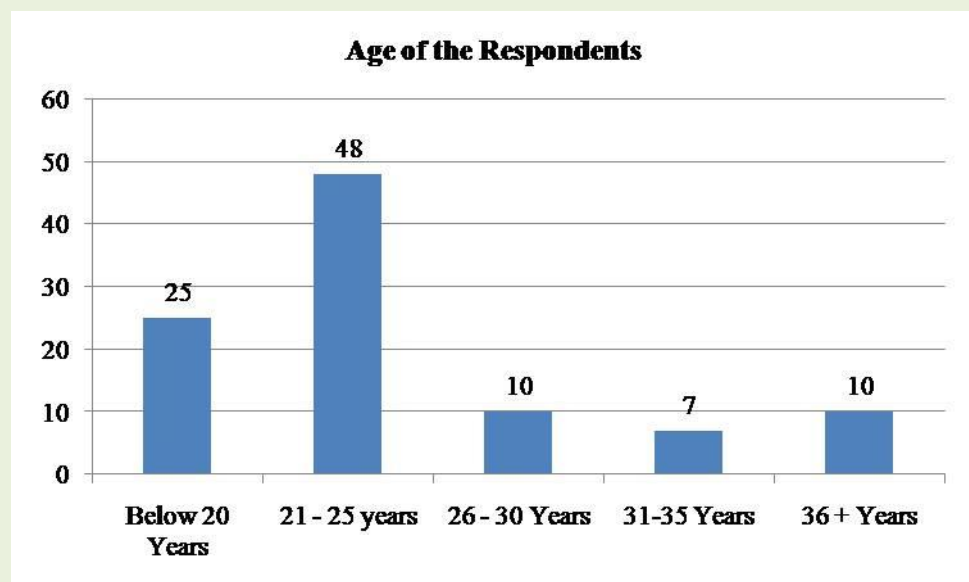
Gender

With regard to the gender of the respondents who provided feedback on the online course, 67% of them were male and 33% of the remaining respondents were female.



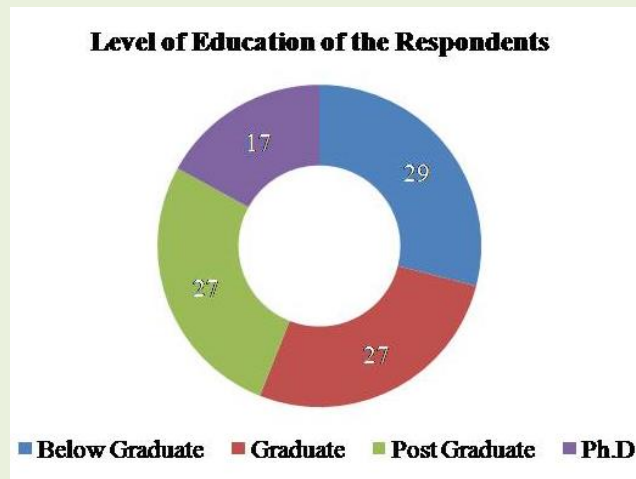
Age of the Respondents

As regards the age of the respondents who provided feedback on the course, it was observed that the highest number of participants were in the age group of 21-25 years constituting 48% of the total respondents, followed by 25% of the respondents below 20 years of age. The respondents in the age groups of 26-30 years and those over 36 years of age constituted 10% of the respondent group respectively, while the remaining 7% of the participants were in the age group of 31-35 years.



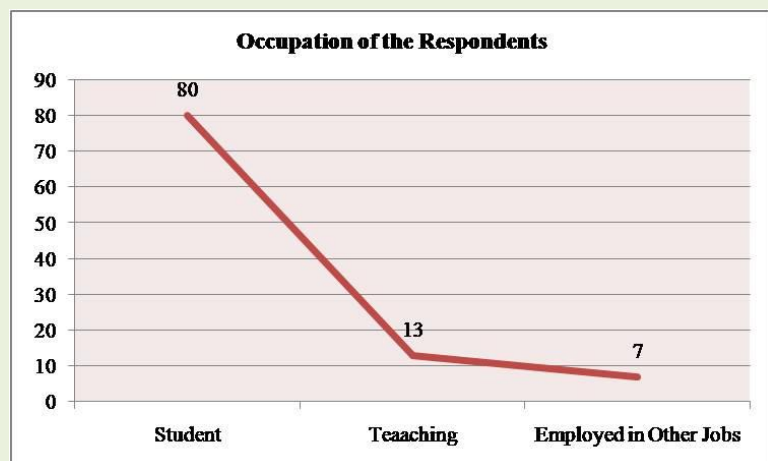
Level of Education of the Respondents

Out of the respondents, it was ascertained that the highest number of participants (29%) had education below the level of graduation. While the number of participants who were pursuing or completed either graduation or post-graduation constituted equal number comprising of 27% each respectively. The remaining 17% of the participants were either pursuing or completed Ph.D degree.



Occupation of the Respondents

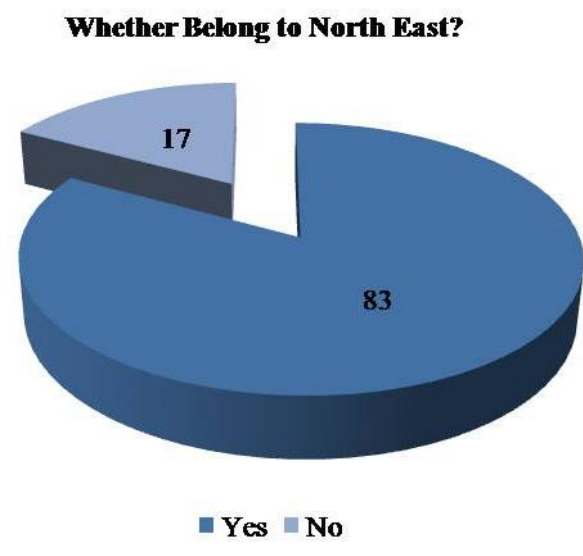
Through the feedback obtained from the respondents, the occupational status of the respondents was ascertained. Among the respondents, vast majority of them who constituted 80% were students who were pursuing their studies at different levels. The remaining 20% of the respondents were employed in various positions while pursuing the course. Among the 20% of the employed respondents, 13% of them



were in teaching positions in different colleges, universities and other educational institutions, while the remaining 7% were employed in other types of jobs.

Do You Belong to North-East?

As part of the feedback, the participants were requested to furnish the details whether they belong to the North-Eastern Region of India. From the consolidated details obtained from the respondents, it was classified and observed that a total of 17% of the respondents belonged to the North-Eastern Region. The specific reason to ascertain this was that, the North Eastern Region

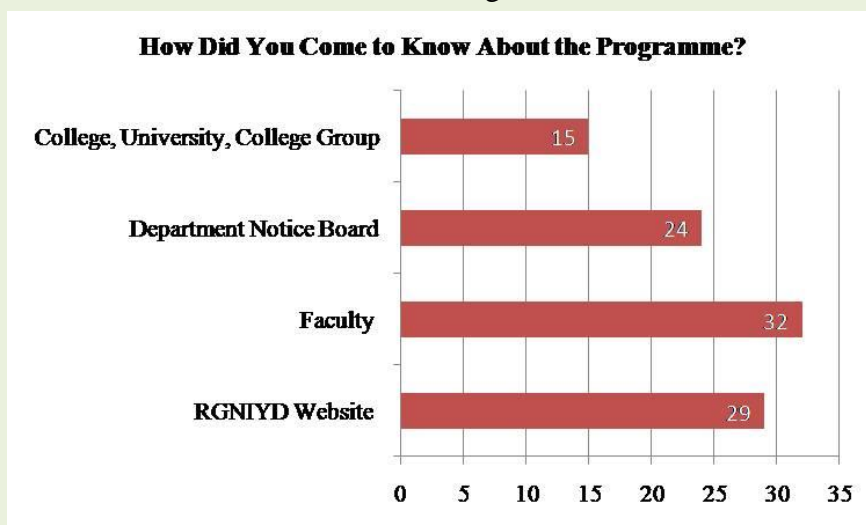


of India deserves much attention in terms of overall development, particularly, with regard to avenues for skill building and education. While the Government of India is continuously working for the uplift of the north-eastern region and allocates special funds for north-east component besides the initiatives of the Ministry for Development of North-Eastern Region, this is a miniscule effort in inclusion and mainstreaming the youth of north-east in the developmental process by providing them skill based education to enhance their employability skills.

Section 2: Feedback about the Programme

How did you come to know about the programme?

RGNIYD took several no cost initiatives to disseminate the details about the Short-term Certificate Course on Nano Technology and Its Applications among the youth, educational institutions, faculty members of various universities and colleges who attended RGNIYD's programmes earlier and youth functionaries through digital modes besides hosting the details on the websites of RGNIYD and the websites of the collaborating institutions. Therefore, it was felt necessary for RGNIYD to make an assessment of what was the major source of information about the course? Therefore, the details

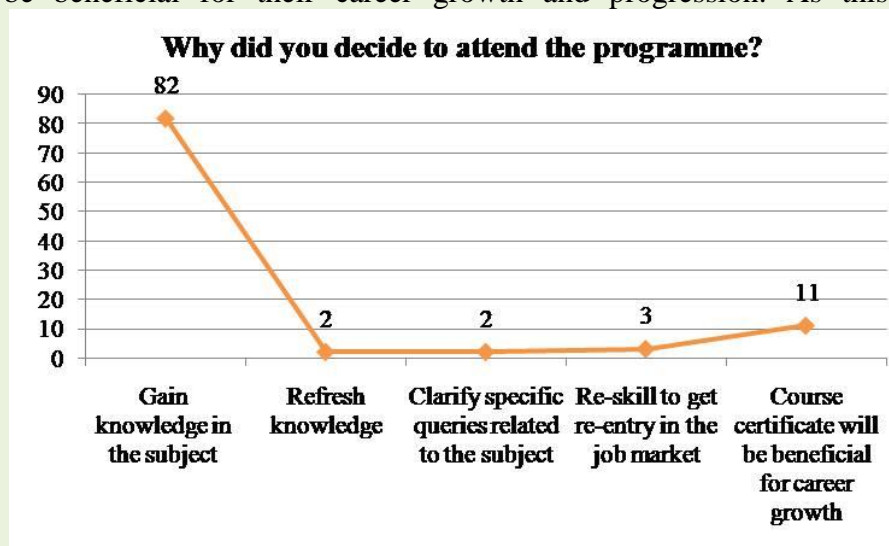


pertaining to the source of information on the course was ascertained through the feedback. From the feedback furnished on this aspect, it was assessed that faculty were the major source of information and about 32% of the respondents got to know about the course through their respective faculty members. RGNIYD's website was another major source of information to the youth of the country. 29% of the participants indicated that they came to know about this course through the information provided on the RGNIYD's Website. Another 24% of the respondents pointed out that they could secure the information relating to the course from their Department's notice board. The remaining 15% of the respondents mentioned that they were provided the details of this course by their respective college or university including their college groups.

Why did you decide to attend the programme?

The another important information imperative for the organizers was to ascertain the reason for the participants to attend the course. From the feedback of the participants, it was determined that a vast segment of youth constituting about 82% attended the course to gain new knowledge

in the subject. As this is relatively an upcoming and trending discipline in Information Technology, large segment of the youth participants evinced keen interest in attending the course. While this course is being offered by various other players, the cost of such courses are very high and cannot be afforded by the underprivileged youth. Therefore, the student who are currently pursuing their education attended the course to gain knowledge and skills to become employment ready. Interestingly, 11% of the respondents revealed that the course certificate will be beneficial for their career growth and progression. As this course was organized in



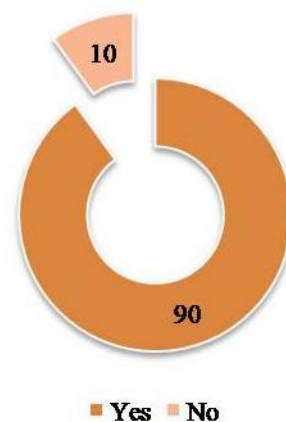
collaboration with the illustrious technological institutions in India viz., the NIT – Tiruchirapalli and NIT – Jalandhar, the Special Centre for Nano Sciences of the prominent Jawaharlal Nehru University including the internationally acclaimed industries such as Seagate Technologies and Boston Scientific Inc

both located in Minnesota, USA, the course certificate will certainly enhance the employability and enrich the CV of the participants by virtue of the brand image of the organizations conducting the course. Another 3% of the respondents mentioned that they attended the course due to the fact that they lost their jobs during the COVID-19 pandemic as a result of downsizing. Therefore, they were looking for avenues to re-skill themselves to get re-entry into the job market. Besides 2% of the respondents each respectively mentioned that they either wanted to refresh their knowledge or clarify specific queries related to the subject. These facts present the clear objective and purpose of the students intent for attending the course.

Did you attend all the sessions?

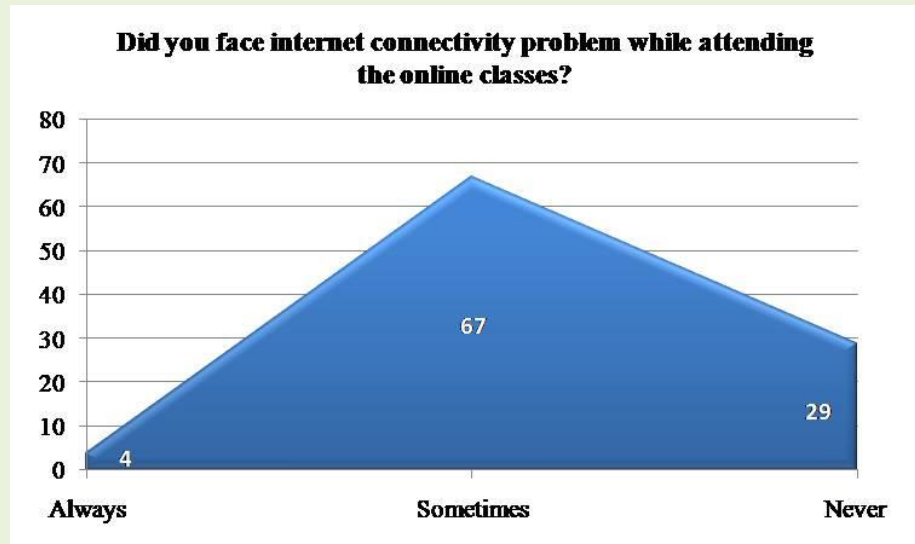
The respondents were requested to furnish the details whether they attended all the sessions of the course? From the feedback provided by the respondents, it was observed that 90% of the respondents mentioned that they attended all the sessions of the course, while 10% of the respondents mentioned that they could not attend all the sessions of the course due to variety of reasons. The specific reasons for not attending were also ascertained through the feedback. Most of the participants ascribed internet connectivity issues as the major deterrent that hindered them from attending all the sessions.

Did you attend all the sessions?



Did you face internet connectivity problem while attending the on-line classes?

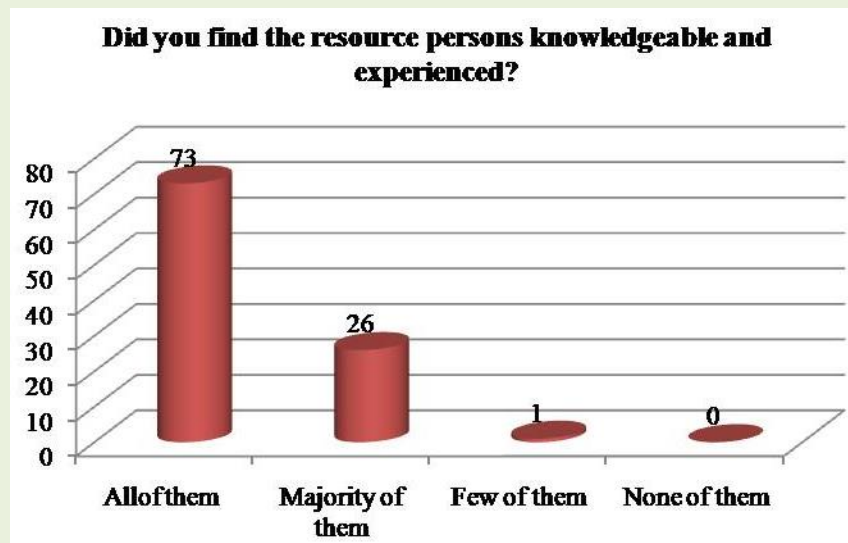
As few participants mentioned that internet connectivity issue was the major problem while attending the sessions, it was felt necessary to what extent the internet issues were hampering the attendance of this course. Therefore, the participants were required to mention whether they faced any internet issues while attending the sessions. Majority of the participants (67%) mentioned that the sometimes faced internet connectivity issues whereas, 4% of the respondents mentioned that they always had internet related problems. The remaining 29% of the respondents indicated that they never faced any internet related problems while attending the sessions during the course. It was further found that students and youth in the rural and far flung villages including the youth in the north-eastern region frequently encountered internet connectivity problems.



Section III: Perception about Online Mode and Resource Persons

Did you find the resource persons knowledgeable and experienced?

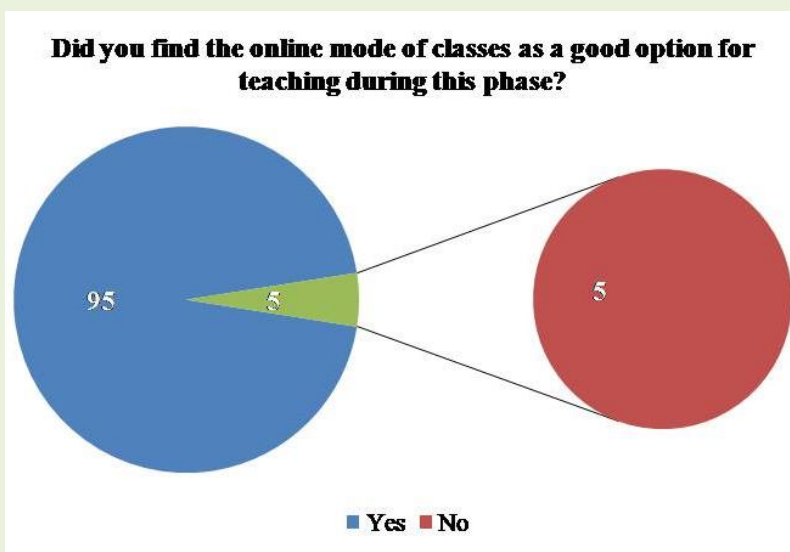
The crucial aspect of obtaining feedback was to find out whether the resource persons have been effective in delivering the content and whether they were resourceful in content delivery? The respondents were asked to rate the resource persons in terms of their knowledge and experience in the subject based on the session facilitated by them. 73% of the participants evaluated that all the resource persons who handled sessions during the course were highly knowledgeable and



experienced. Another 26% of the respondents rated that majority of the resource persons were knowledgeable and experienced whereas, only 1% of the respondents indicated that few of the resource persons were knowledgeable and experienced in their subject. It is noteworthy to mention that none of the participants indicated that the resource persons were not knowledgeable and experienced. It is pertinent to mention here that the sessions during the course were handled by specialist faculties from the collaborating institutions viz., NIT-Tiruchirapalli, NIT-Jalandhar, Special Centre for Nano Sciences, JNU, New Delhi and from the industry partners Seagate Technologies and Boston Scientific, USA respectively.

Did you find on-line mode of classes as a good option for teaching during this phase?

The organizing institution sought to ascertain whether online mode of education was a good option for teaching during the lockdown phase as a result of COVID-19 pandemic? To this, vast majority of the respondents (95%) expressed their view through their feedback that the online mode of classes were the only option which was the most suited and effective method to offer education during difficult



situations like this pandemic lockdown phase. The remaining 5% of the respondents felt that online method of teaching was not a good option during the pandemic situation due to their personal reasons. While this was the only mode available to continue educational and skill building endeavours for the entire world, RGNIYD could optimally utilize the online platform for effectively imparting skill-based job-oriented courses for the youth in order to utilize the time in a most advantageous manner.

Which aspects /lectures of the programme were very stimulating for you?

The participants were asked to provide details about which aspect of the programme or lecture was very stimulating for them? To this query, variety of responses emerged. The primary response the in-depth discussions and application orientation provided during the programme was much stimulating to the participants. Further, the participants named the titles of

Which aspect /lecture of the programme was very stimulating for you?
192 responses

Nano Materials for Energy Applications
All
All
Nano Technology
In-depth discussion and applications
Nanotechnology for high frequency and Medical Device Applications
MRI contrast agent & Hyperthermia therapy
Nano technology
Dr.veerakumar sir, Dr. Bijoy Kumar sir

few session which they found interesting viz., Nano Technology, Nano Materials for Energy Applications, Nano Technology for High Frequency and Medical Device Applications and MRI Contrast Agent & Hyperthermia Therapy. Few names of the resource persons were also mentioned by the participants in response to this question. The names of resource persons indicated by the participants in response to this query were Dr. Veerakumar and Dr. Bijoy Kumar.

What are the key messages you got attending the programme?

The participants of the short-term course on nano technology and its applications were requested to provide feedback on the key messages they got by attending the programme. Range of responses to this query emerged. Most of the participants indicated that they assimilated good amount of knowledge by attending this course. Another segment of participants indicated that the wide application value of nano technology in different fields were the key takeaway for them. While, a few participants indicated that they assimilated new information on nano technology and its applications.

Participants from higher institutions of technology mentioned that they got new and useful research insights on nano technology. Few other participants indicated that the details provided on photo-catalysis and nano-materials for environmental applications were very useful to conduct research, including the in-depth knowledge provided on the medical devices and bio-sensors for diagnosis will be much useful to pursue career in those aspects. Many other participants also made a note that the faculty who handled various sessions provided them good amount of guidance for pursuing higher education, research and details on career opportunities and also provided important links for free online courses on various aspects of this discipline.

What are the key messages you got attending the programme?

192 responses

Short - term certificate course on NANO technology & its applications (An Industry & Institute Partnership Program)

Knowledge

Wide applications of nano technology in different field

Important links for free courses, photocatalysis and nanomaterials for environmental applications which are useful for my research

Lot of messages

Many things and good knowledge about nano technology

medical devices, biosensor for diagnoses that are help full for my carrier,

Nanotechnology a good group for research

Would you like to attend the similar programme in future?

The participants of this course were inquired about their willingness to participate in various other programmes to be organized by RGNIYD in future. Almost all the respondents expressed their willingness to attend in the future programmes to be conducted by RGNIYD. The youth who have been attending various programmes of this nature have earlier appreciated about the nature and standard of the programmes of the Institute. Further, the RGNIYD courses in-built with

Would you like to attend the similar programme in future?

192 responses

Yes

yes

Yes

YES

Sure

Yes definitely

Yes, definitely

yes

yes of course

high quantum of flexibility, the design and structure of the programme, content, delivery method, faculty and other organizational aspects have been a great attraction to the youth. The main aspect is the collaborations that RGNIYD brings in for each course is the hallmark and brand image for the courses implemented. Therefore, it is certain that youth of the country are keenly looking at RGNIYD to organize such useful programmes to build their careers.

What would you like to say about this course to a student who is considering taking it in the future?

In response to the question whether they will recommend this course to a student or youth who is considering to attend in future, almost all the participants have remarked that it is a must to attend such programmes which are very beneficial and provide new outlook for emerging careers blended with latest application value and skills. While these kinds of courses were initially rolled out, there was very less response. Wherein, the participants of RGNIYD's courses later turned out to be the ambassadors to spread the message about the benefits of RGNIYD's programmes. Further, many faculty and researchers from prominent institutions are continuously attending various courses of RGNIYD who also are strongly advocating their students to attend the courses of RGNIYD. Recently, few NITs have also given instructions to their students to participate in RGNIYD courses to enhance their knowledge and skills.

What would you like to say about this lecture series to a student who is considering taking it in the future?

192 responses

Yes

Must attend

yes

Very Good

No

YES

Good

Very beneficial

These lectures provide the greater outlook and overview of nanomaterials and their latest applications

Do you have any suggestions for future courses that would help us improve the quality of our Courses?

The participants were asked to provide their suggestions to improve the quality of RGNIYD courses. While there were not much suggestions, one of the vital suggestion that emerged was to provide more opportunities for the students pursuing diploma programmes so that they can benefit out of the skill training and job-oriented courses being offered by RGNIYD. Further, it was suggested to provide more IT and mechanical engineering related programmes may also be offered for diploma students.

Do you have any suggestions for future courses that would help us improve the quality of our series?

192 responses

No

Yes

no

No suggestions

Na

Diploma students should bring programs for these mechanical fields so that more information can be provided to the students.

Nothing

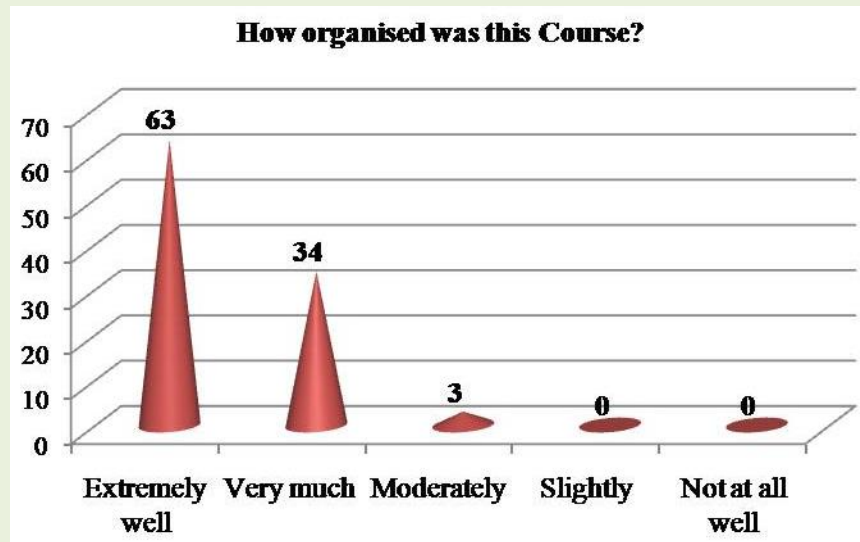
Nothing

Section IV: Perception about Course Management

This section provides details on the feedback of the participants regarding the course management.

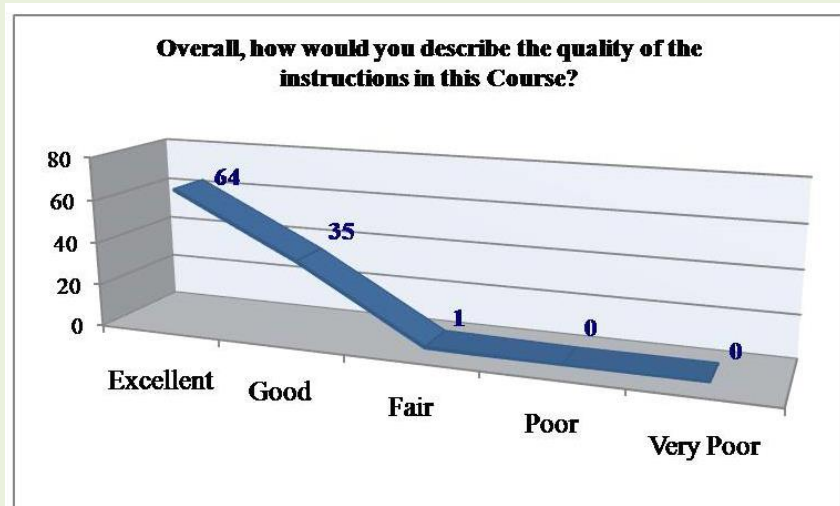
How organized was this Course?

The participants were required to provide their comments on the organizational aspects of the course and its degree. Majority of the respondents (63%) who provided feedback felt that the course was extremely well organized, while another large group of respondents (34%) felt that the course was much organized. Only 3% of the participants felt that the course was moderate in terms of organizational aspects. While no participant felt that either the course was not well organized or was slightly organized in nature.



Overall, how would you describe the quality of the instructions in this Course?

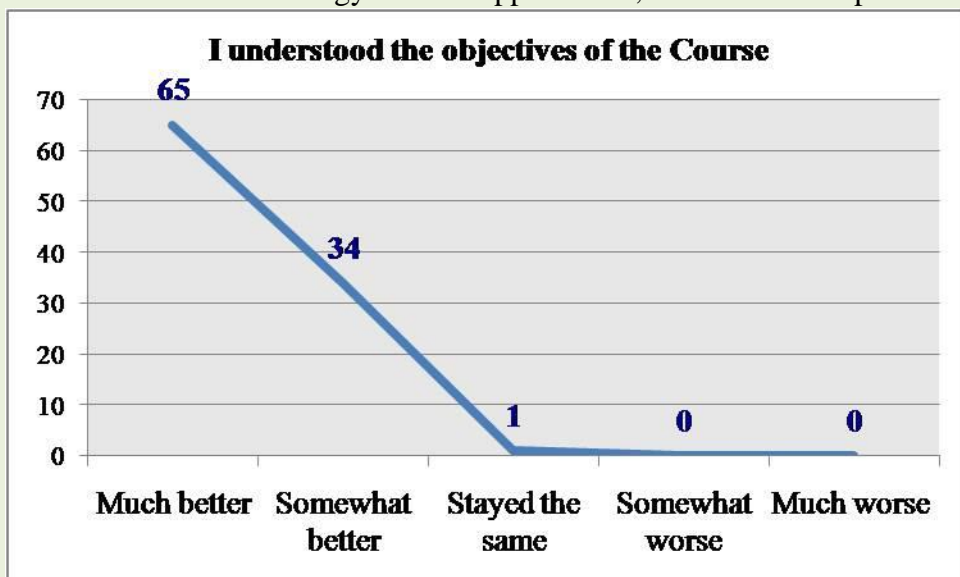
With regard to the quality of instructions imparted during the course, 64% of the participants rated that the instructions were excellent, while 35% of the participants evaluated the instructional quality of the course to be good. Only 1% of the respondents remarked that the quality of instruction during the course was fair. However, none of the participants rated the instructional quality of the course to be poor or very poor. This feedback provides an encouraging response from the participants that almost 99% of the participants felt that the quality of teaching and instructions were either



excellent or good. There was no negative feedback in this aspect which shows the standard of the course content delivery.

I understood the objectives of the Course

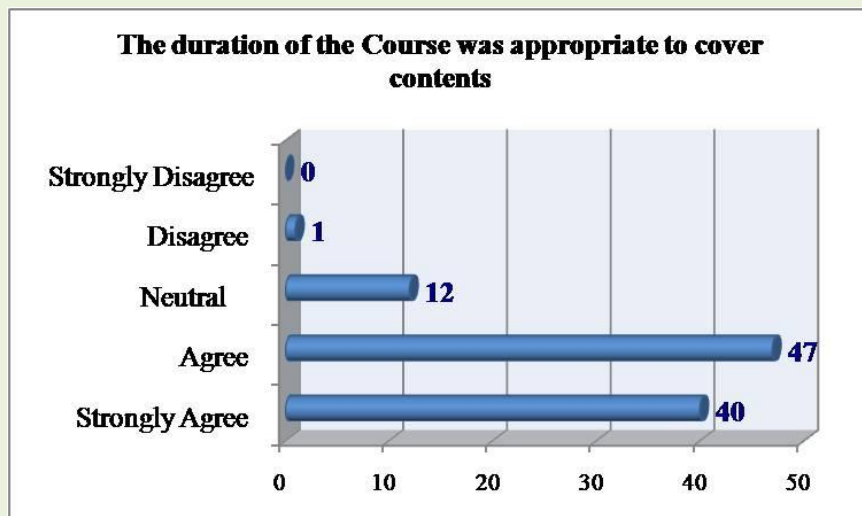
When the students were probed on the extent to which they understood the objectives of the short-term certificate course on nano technology and its applications, 65% of the respondents who attended the course stated that they understood the objectives of the course much better. 34% of the respondents mentioned that they understood the objectives of the course somewhat better while 1% remarked that their level of understanding on the objectives of the



course remained the same even after attending the course. While there were varying levels in the educational backgrounds of the respondents, it is very difficult to cater to the needs of all the learners. While the number of participants of the present course was very large and were wide-spread differences in terms of education, skill levels and experience, it may not be possible to satisfy the dispersive needs of all the learners. Further, the participants with less exposure on IT related aspects would have experienced difficulty in comprehending the entire range of concepts imparted during the course.

Appropriateness of the duration of the course to cover contents

In the feedback, the participants were required to provide their opinion on whether the duration of the course was adequate to appropriately cover the contents envisaged to be delivered to which 47% of the participants felt that the duration of the course was adequate to cover the entire range of

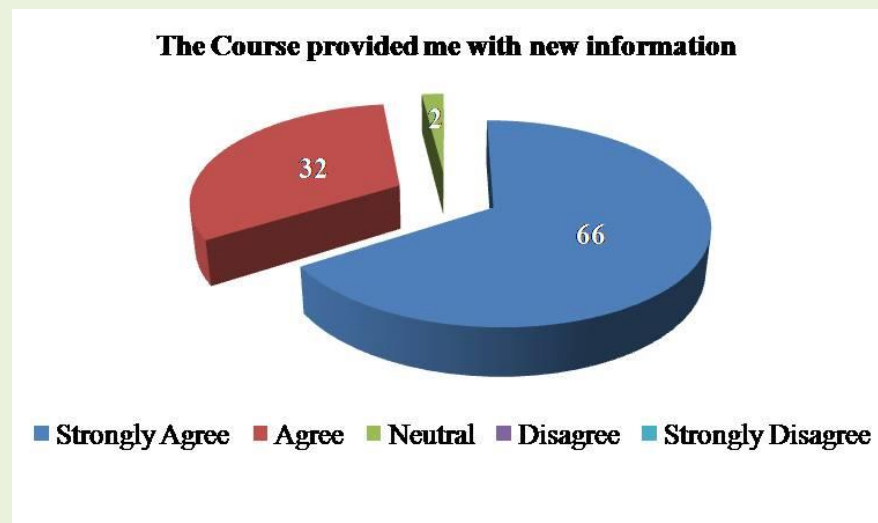


contents. About 40% of the respondents agreed that the duration of the course was appropriate to cover the contents wherein, 12% of the participants neither were persuaded about the duration of the course nor were dis-satisfied with the duration of the course. Only 1% of the participants disagreed that the duration of the course was not adequate to cover the entire content.

The Course provided me with new information

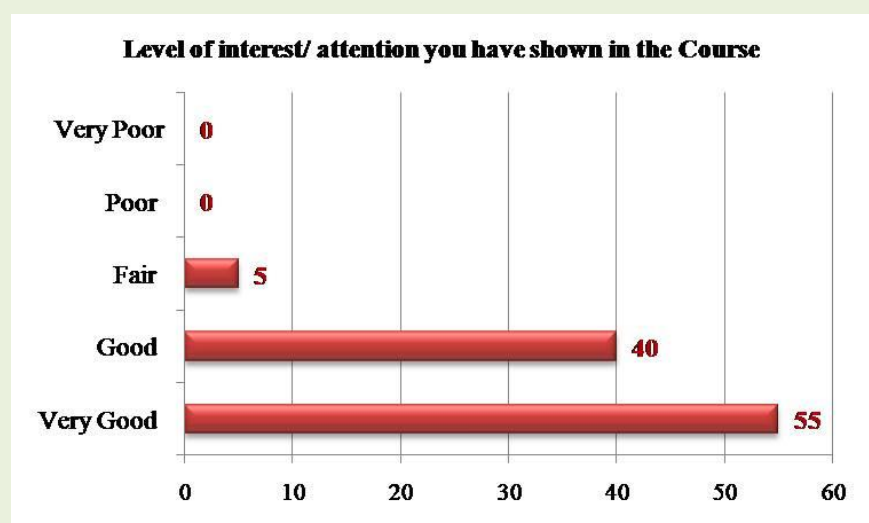
While the respondents were asked to mention whether the course provided them new information, 66% of the respondents strongly agreed that the present course provided them new information and acquired new knowledge and skills.

Another 32% of the respondents agreed that they acquired new information. In total, about 98% of the respondents either agreed or strongly agreed to the fact that they got new information by attending this course. Only 2% of the respondents neither agreed nor disagreed to this. They were undecided that the information that they gained was new to them. This may be possible because, there were a sizable segment of participants who were either engaged in teaching with Ph.D degrees or were performing other related jobs. Therefore, it may not be fair to expect that the information imparted in any course will be new to all the participants, provided, the selection criteria are strictly adhered to.



Level of interest/ attention you have shown in the Course

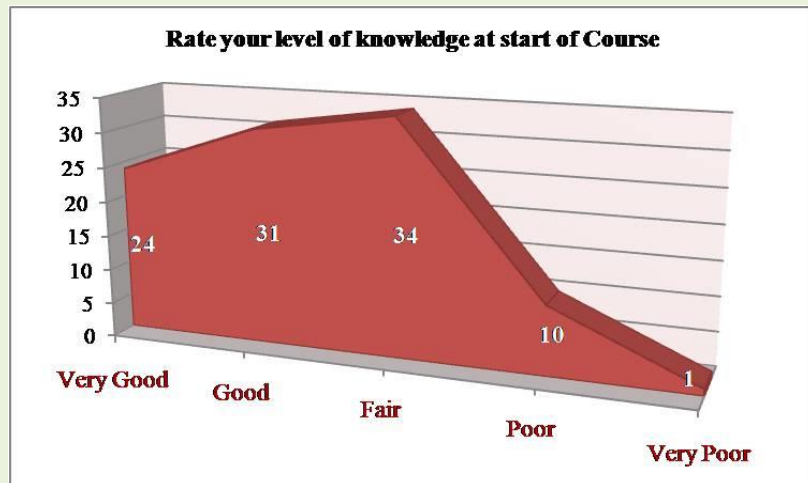
The participants were asked to do a self-rating on the degree of interest and attention evinced during the course. Among the respondents, 55% rated their level of self-interest and attention shown in the course as very good, whereas, 40% of the respondents mentioned that their degree of attention and interest shown by them was good. Remaining 5% of the



respondents reported that they demonstrated fair amount of attention and interest during the course.

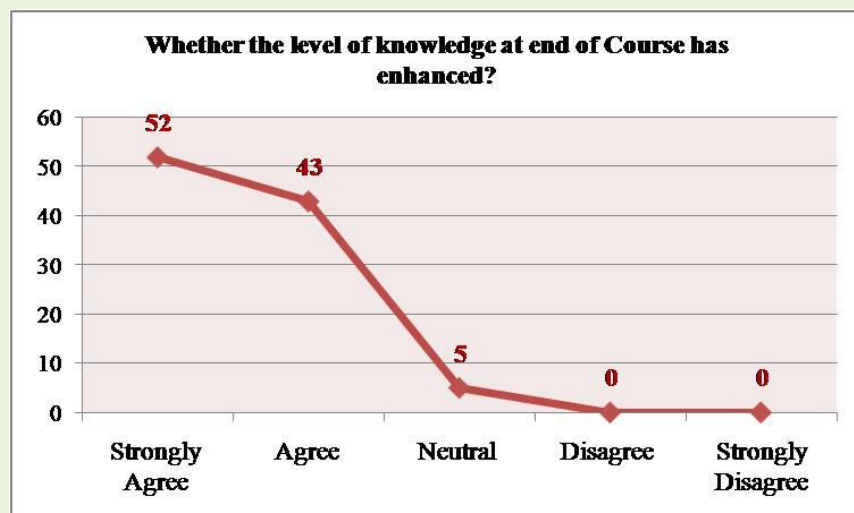
Rate your level of knowledge at start of Course

With regard to the self-rating on the level of knowledge at the start of the course regarding nano technology, 34% said that they had fair amount of knowledge, 31% conveyed that they had good level of knowledge at the start of the course, where as another 24% of the respondents stated that their level of knowledge regarding nano technology was very good at the start of the course. On the other hand 10% of the respondents indicated that their level of knowledge on nano technology and its applications was poor at the start of the course and 1% of the respondents pointed out that their level of knowledge was very poor on the subject at the start of the course.



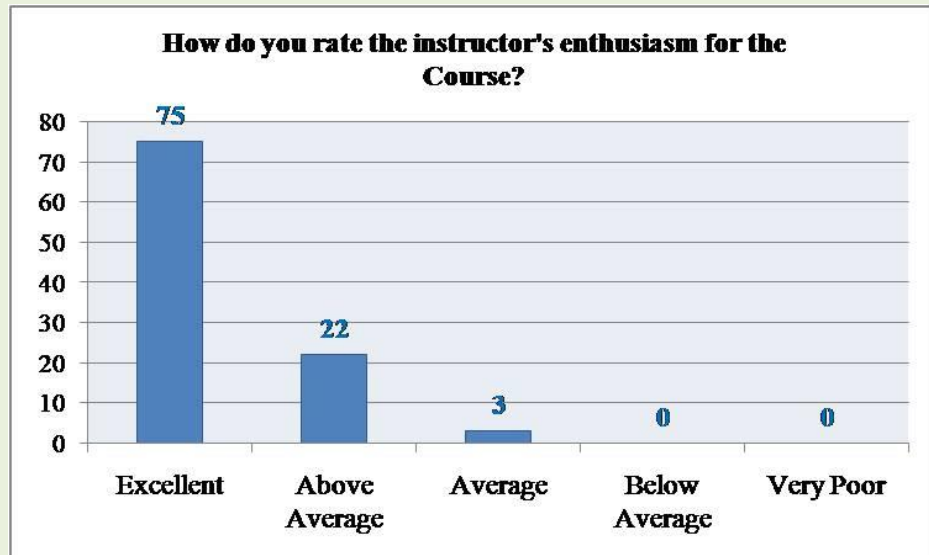
Whether the level of knowledge at end of Course has enhanced?

On completion of the course, the participants were asked to self-rate themselves in terms of the level of knowledge gained at the end of the course and whether the course had any impact in enhancing their knowledge on the subject? More than half of the respondents (52%) strongly agreed that their level of knowledge on the subject was enhanced as a result of attending the course, while 43% agreed that at the end of the course their knowledge was enhanced. 5% of the respondents remained undecided as to whether their level of knowledge was enhanced or not as a result of attending the course. However, there was no disagreement on the notion that the course enhanced the levels of knowledge and understanding on the subject.



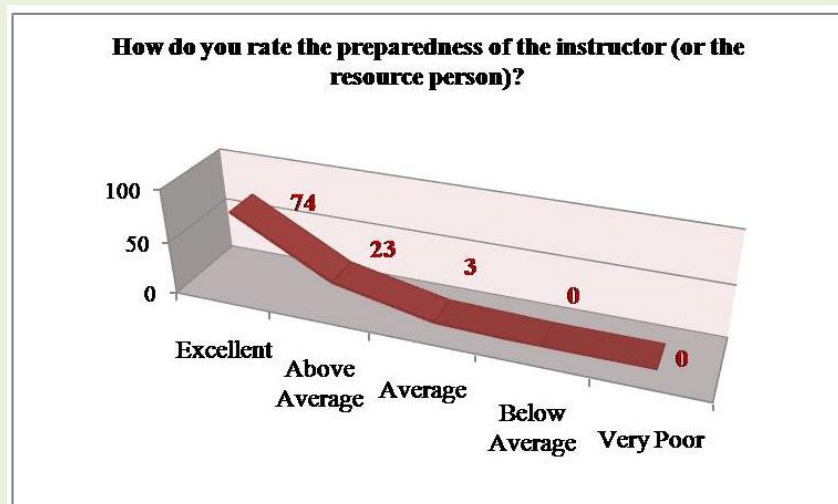
How do you rate the instructor's enthusiasm for the Course?

With reference to the enthusiasm of the faculty during the course, the participants provided their ratings as part of the feedback. A vast majority of the participants consisting of 75% described the instructor's level of enthusiasm during the course as excellent, where as 22% of the respondents depicted that the instructors' level of enthusiasm was above average and about 3% indicated that the level of enthusiasm demonstrated by the resource persons during the course was at an average level. None of the participants rated the levels of enthusiasm of the resource persons as below average or very poor.



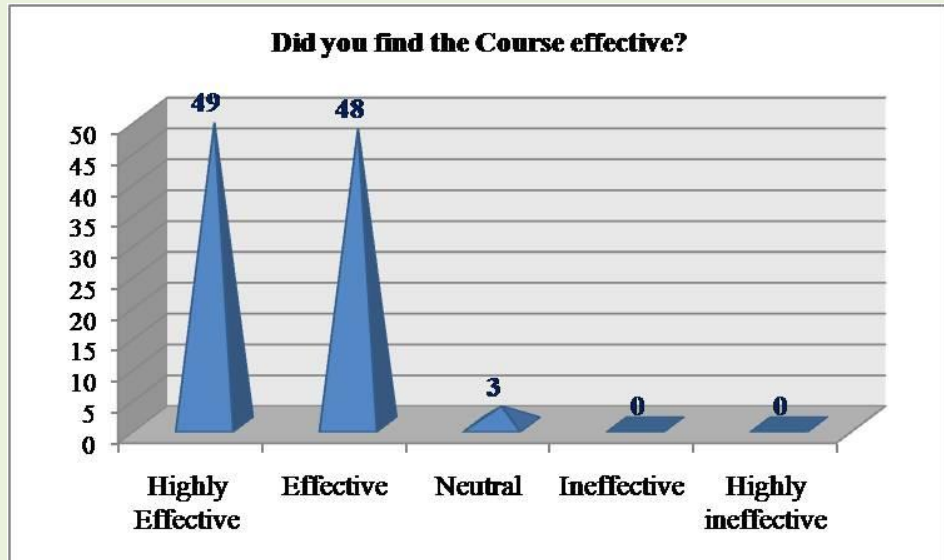
How do you rate the preparedness of the instructor (or the resource person)?

The level of preparedness of the resource person (instructor) is very essential for the effectiveness of any programme. The participants were requested to provide their ratings on level of preparedness of the instructors during the course. A large segment of the respondents consisting of about 74% specified that the levels of preparedness of all the resource persons were excellent, whereas, 23% of the respondents rated the levels of preparedness of the resource persons as above average while 3% of the respondents rated the level of preparedness of the resource persons at an average level. There were no ratings for below average and very poor as regards the level of preparedness of the resource persons during the course.



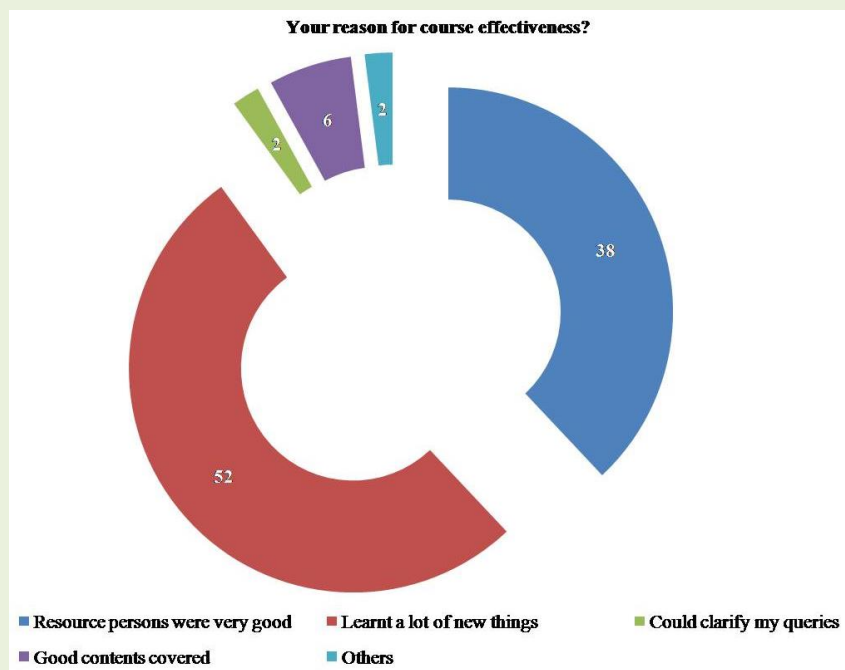
Did you find the Course effective?

The participants as part of the feedback provided their ratings on the overall effectiveness of the course. About half the respondents (49%) mentioned that the course was highly effective while an almost equal proportion of the respondents consisting of about 48% rated the course to be effective. Therefore, a total of 97% of the respondents provided a satisfying rating regarding the effectiveness of the course as either highly effective or effective while, a miniscule 3% of the respondents maintained neutrality in terms of course effectiveness who were indecisive on the degree of effectiveness of the course. None of the participants mentioned that the course was either ineffective or highly ineffective. This is ultimate outcome and the precise feedback on the course by the participants. Almost all the participants felt that the course was effective which demonstrates the success of the programme that it could cater to the learning needs of the participants as well as assuring them of the quality and standard of the course.



Your reason for course effectiveness?

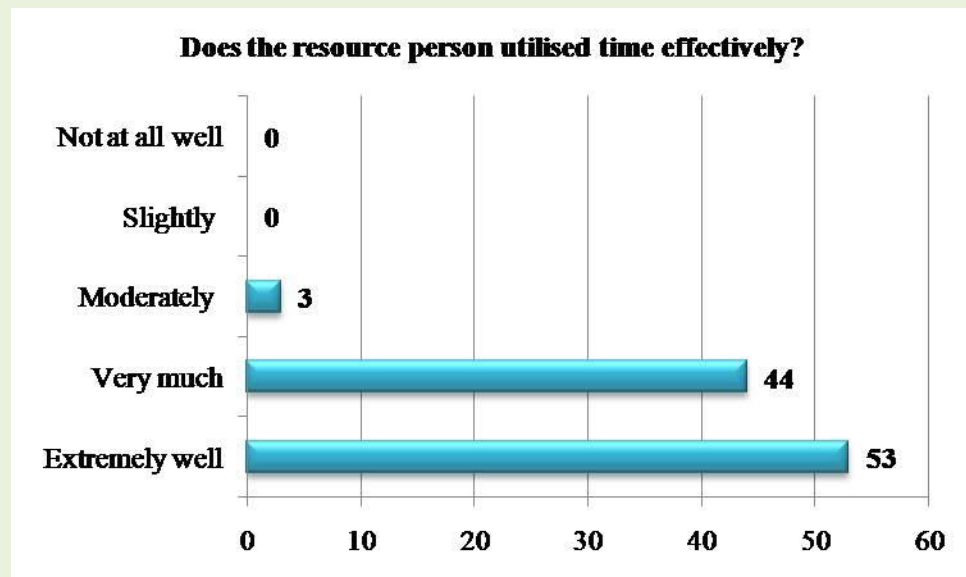
In the feedback form, the participants were asked to state their reason for the course effectiveness. Various responses emerged to this aspect. A large proportion of the respondents (52%) mentioned that that they learnt a lot of new things. 38% of the respondents mentioned that the reason in the second order for the course effectiveness was due to the fact that the resource persons



were very good. Another 6% of the participants revealed that their reason ascribing to the effectiveness of the course was because good contents were covered in the course. 2% of the participants felt that the course was effective for the reason that they could clarify their doubts. A small number of participants (2%) had other reasons for stating that the course was overall effective.

Does the resource person utilized time effectively?

The participants were asked to indicate whether the resource persons during the course utilized the time effectively? 53 % of the participants mentioned that the resource persons utilized the time extremely well whereas, another 44% of the respondents stated that the resource persons utilized the time provide to them to facilitate the session very effectively. 3% of the respondents made a mention that the resource persons moderately use their time with effectiveness. It is pertinent to mention here that all the resource persons used variety of teaching methods and used

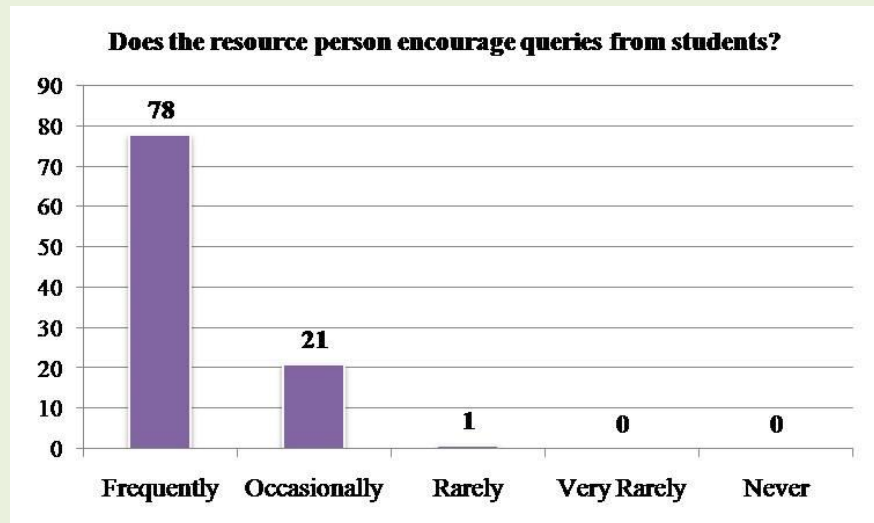


multi-media presentations, screened videos, pictures, models, prototypes, portraying web-resources apart from the traditional powerpoint presentations. A few resource persons conducted online polls to assess the pre and post knowledge gained from those sessions. Further, the last few minutes were reserved for questions and clarification of doubts. Therefore, all the resource persons utilized their time with much consciousness and effectiveness. In fact, it was one of the suggestion that the time slot needs to be increased to have more interactions for each session.

Does the resource person encourage queries from students?

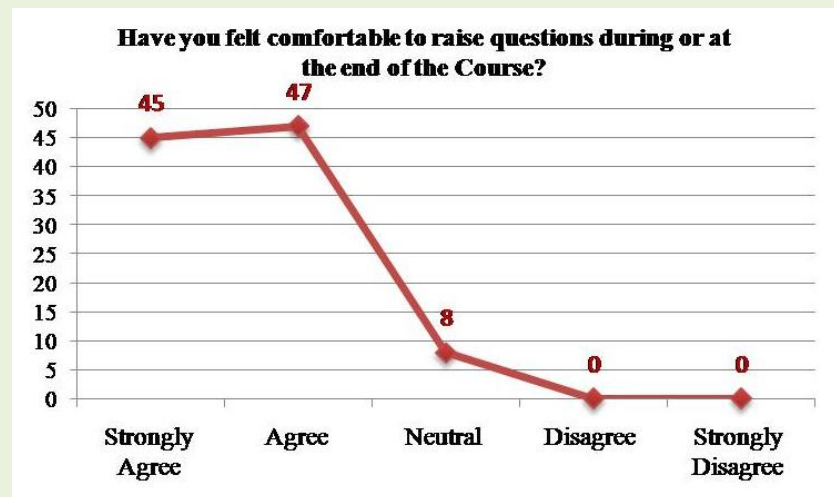
With regard to the feedback whether the resource persons encourage the participants to ask questions and clarify their doubts, 78% of the participants mentioned that the resource persons frequently encouraged them to ask questions and get clarification for their doubts. 21% of the respondents provided a feedback that occasionally the resource persons encouraged them to ask questions while 1% mentioned that the resource persons rarely encouraged them to ask queries and get clarifications for their doubts. However none of the participant remarked that the resource persons very rarely or never encouraged them to ask questions. It was a standing instruction to all the resource person to reserve the last 10 minutes before they conclude their session for questions and answers session so that the participants if they miss to ask or clarify

their doubts during the courses of the session could get their doubts clarified by the resource persons at the end. Therefore, adequate scope was provided to all the participants to raise queries during each session. Further, all the resource persons encouraged the participants to get their doubts cleared even during the later period through e-mail.



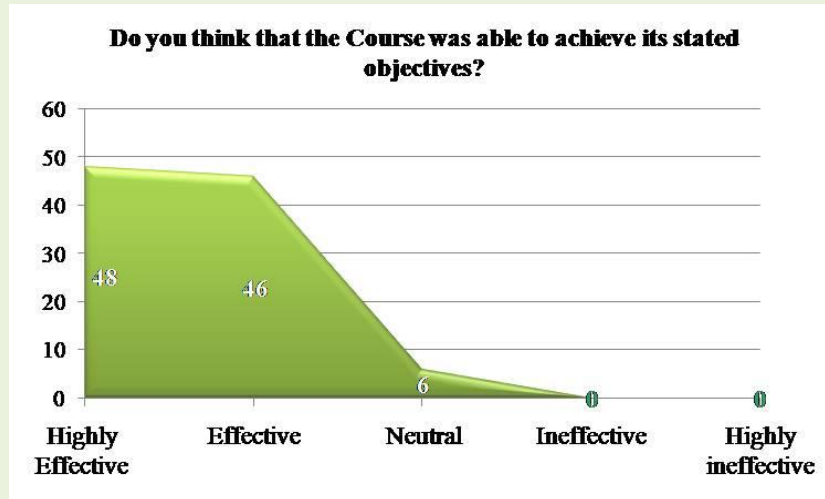
Did you feel comfortable to raise questions during or at the end of the Course?

Conversely, the participants were asked to express whether they felt comfortable to raise questions during the course of the session or at the end. 45% of the participants strongly agreed and 47% of the participants agreed that they felt very comfortable to ask question and clarify their doubts at any point of the session be it during or at the end of each session. In addition, chat option was also available for the participants to ask questions in case if they were not confident to ask questions orally. The participants were provided full freedom to ask any question relating to the subject and clarify their doubts as it was much imperative due to the fact that each session was interlinked and the content was covered in a logical sequence. Therefore, without clarity in one session, progression into the successive session would create confusion. Hence, the participants were encouraged to ask questions at any point of time.



Do you think that the Course was able to achieve its stated objectives?

The final question on the feedback form was whether the course was able to achieve its stated objectives? Over 48% of the participants indicated that the course was highly effective in achieving its stated objectives, where as another 46% of the respondents mentioned that the course was effective in achieving its stated objectives. About 94% of the participants felt that the course was either highly effective or effective in achieving its objectives. This is a clear indication that that the course was conducted in a structured and systematic manner with appropriate content delivered by prolific resource persons from within the country as well as from abroad. The overall feedback states that the course was able to achieve its stated objectives. This demonstrates the degree of overall effectiveness of the course.



Copy of the Certificate



Profiles of Resource Persons

Prof. Bijoy Kumar Kuanr

Chairperson
Special Centre for Nano Sciences
Jawaharlal Nehru University
New Delhi.

Prof. Bijoy Kumar is currently the Chairperson of the Special Centre for Nano Sciences at the Jawaharlal Nehru University, New Delhi.

He obtained Ph.D in Electronic Science from Delhi University and pursued his Masters and M.Phil in Physics from Delhi University.


Previously he served as the Post-Doctoral Fellow at the Prof. Nimtz's lab, Universität zu Köln, Köln, GERMANY and worked with Prof. Peter Grünberg (Nobel laureate Physics) in GMR-Sensor, he was also the Post-Doctoral Fellow at Ruhr - Universität Bochum, GERMANY, a Research Scientist at the Research Center Jülich, JÜLICH, GERMANY, Research Faculty in the Center for Magnetism and Magnetic Nano-structures, University of Colorado, Colorado Springs, USA

He has secured several awards and honours such as the Co-researcher of Nobel Laureate Physics 2007 – by Prof. Peter Grünberg, JÜLICH, GERMANY, he was the DAAD Fellow - Universität zu Köln, Germany in 1994 and DAAD Fellow - Universität Bochum, Germany in 1999 (DAAD is the world's largest funding organisation for the international exchange of students and researchers)

He was conferred the award for Fellow of the Structural Engineering Research Centre of the Department of Science and Technology, Government of India in 1998. He was awarded the Senior Research Fellowship in 1998 by the CSIR, Government of India.

He has significant collaborations with various international institutions, organisations and agencies and offers academic and research consultancy to the Research Center at JÜLICH, GERMANY, Center for Magnetism & Magnetic Nanostructures, University of Colorado, Colorado Springs, USA, Electromagnetic Division - Advanced High Frequency Devices, NIST, Boulder Laboratories, Colorado, USA, Advanced Materials Research Institute, University of New Orleans, USA, Seagate Technology, Bloomington, Minneapolis, USA and Department of Physics, University of Memphis, Memphis, USA

He has published over 100 articles highlighting his research contributions in world renowned peer review journals and has authored several books to his credit.



His areas of interest/specialization include Nano-electronics:Spintronic; Giant-Magneto-Resistance (GMR) Sensor for READ-WRITE head of computerhard-drive;MMIC -Microwave Monolithic Signal processing Nano Devices; Magnetic nanocomposite based Microwave absorber for Stealth Technology, Nano-bio-electronics: GMR-Bio-Sensor; Radio-Frequency Hyperthermia for Cancer treatment.

His research towards “Nano Technology and its Applications” started since 1994, when I joined the Microwave Electronics Laboratory of Prof.Nimtz at University of Köln, and Prof.Grünberg (Noble Laureate - Physics 2007) of Research Centre Julich, Germany to fabricate and characterize Giant-Magneto-Resistance (GMR) sensor structures for READ-WRITE head of computer hard-disks.

Dr. R. Justin Joseyphus

Associate Professor

Department of Physics

National Institute of Technology Tiruchirappalli,

Tamil Nadu

Dr. R. Justin Joseyphus is presently an Associate Professor in the Department of Physics at the NIT – Tiruchirappalli, Tamil Nadu. He received his Ph.D in the area of nanocrystalline magnetic materials from University of Madras. He pursued his post-doctoral research in Tohoku University, Sendai, Japan.

He has undergone specialized training in Electron microscopic techniques from the University of Pune, Thermal Analysis from IIT- Madras, Computer simulations from the Madurai Kamaraj University, In-vitro cell culture from the King Institute, Guindy, Chennai besides hands on training from the Defence Metallurgical Research Laboratory (DMRL) - DRDO, Hyderabad, Bhabha Atomic Research Centre (BARC), Mumbai, Getwell Hospitals, Tamil Nadu

He joined the Department of Physics as faculty and has over two decades of teaching and research experience. He has published more than 50 research articles in internationally reputed journals. He has presented his research work in more than 40 international and national conferences and has made presentations and very widely in countries such as USA, Japan, Singapore, Canada, Spain, Slovakia. He has organised and participated in various seminars in his areas of specialization. He has contributed various chapters in many popular books.

He has immensely contributed to research on soft and hard magnetic materials. His current research interest is to obtain enhanced magnetic properties in nanoparticles. Research area of interest include Polyol process, magnetic nanoparticles, Mossbauer spectroscopy, magnetic nanoparticle hyperthermia, Fe based alloys.

He has undertaken research projects on Development of Magnetic Nanoparticles Suitable for Detoxification and Drug Delivery from the Department of Science of Technology, Synthesis and characterization of nanomaterials for engineering applications with funding from DST-Nanomission.

On a project visit he undertook a study on the Order disorder studies in chemically synthesized FeCo alloys, DST, KEK, Tsukuba, Japan.

He was a recipient of the UGC Fellowship, Senior Research Fellowship from CSIR, MEXT research fellow, Japan, COE fellow, Japan and secured the best poster award at ISHR&ICSTR 2006, Japan. He obtained the illustrious Post-doctoral Fellowship in the Graduate School of Environmental Studies, Tohoku University, Sendai, Japan. He is a certified Chartered Physicist by the Institute of Physics, United Kingdom.

He is a member of the Indian Physics Association, Magnetism Society of India, Materials Research Society of India, Indian Society for Non-Destructive testing and is the Elected Member (MInstP), Institute of Physics (IoP), UK - Since 2011.

Dr. K. N. Sheeba

Associate Professor
Department of Chemical Engineering
National Institute of Technology
Tiruchirappalli, Tamil Nadu

Dr. K. N. Sheeba is currently an Assistant Professor in the Department of Chemical Engineering at the National Institute of Technology, Trichy, Tamil Nadu. She completed her B.Tech in Chemical Engineering from Madras University in 2000, M.Tech in Energy Engineering from Bharathidasan University, Trichy. She later pursued her doctoral degree in Energy Engineering from National Institute of Technology, Trichy. She has undergone several short term courses from various institutions of higher learning including a month long training in biomass gasification at University of Saskatchewan, Canada based on which she has set up a research laboratory on Fossil and alternate Fuel processing laboratory at NIT-Tiruchirappalli.

Previously she worked as a Research Associate at the Regional Engineering College, Trichy, Lecturer at SASTRA University, Tanjore, Tamil Nadu. She is a Member of the Board of Governance and a Doctoral committee Member besides serving as a Reviewer of various internally accredited Journals.

She secured the Young scientist award from the Department of Science and Technology, and the Most Inspiring Women Engineer conferred by Engineering Watch, New Delhi. She has guided over 50 PG projects and has undertaken various Major R&D Projects viz., Combined pyrolysis and steam gasification to establish multi fuel production with maximized hydrogen yield undertaken through Department of Science and Technology, Government of India and Monitoring of sea bed and sea water quality through the Ministry of Environment and Forests.

She has published over 25 research articles in internationally reputed Refereed Journals, published her contributions in over 30 Conferences/Workshops/Symposia Proceedings. She has also authored books published by Lambert Academic Publishing Company, Germany and Studium Press, USA.

She has participated in several conferences, seminars and symposia on different aspects and has organised many Workshops/ Symposia/ Conferences/ Colloquia/Seminars. She has also delivered several invited talks widely across the country.

On academic foreign visits she has delivered series of lectures in various higher learning institutions across Canada, Malaysia and Dubai. Her other professional areas of interests include Biomass and Bioenergy, Industrial safety.

She is a member of various Learned Societies such as Solar Energy Society of India, National Society of Fluid Mechanics & Fluid Power, Institution of Engineers, Indian Institute of Chemical Engineers, The Society for Advancement of Electrochemical Science and Technology.

Professor (Dr) N. C. Kothiyal

Professor

Department of Chemistry and Dean Faculty Welfare

National Institute of Technology

Jalandhar, Punjab.

Dr. N. C. Kothiyal is the Professor in the Department of Chemistry and Dean of Faculty Welfare at the NIT- Jalandhar and was previously heading the department. He is also the Member Board of Governors and the Member of Finance Committee at NIT Jalandhar.

He pursued M. Sc Chemistry with specialization in Organic Chemistry at the Central University, Srinagar, Uttarakhand and obtained his PhD, from the Indian Institute of Technology, Dhanbad (Indian School of Mines, Dhanbad), Jharkhand. He started his career at ISM, Dhanbad and now he possesses About 30 years of Teaching and 35 years Research experience. He has guided more than 10 Ph.D. candidates and several M.Sc and B. Tech projects.

He is an External Expert of the Board of Studies in various renowned universities and technological institutions across the country, besides being a PhD Examiners for various Institutes, Universities, and Academy of Scientific and Innovative Research of the CSIR. He is serving as a Member of the selection committee for the Department of Technical Education, Govt. of Punjab, Chandigarh and other institutes and advisor for the Uttarakhand state council for science and technology (UCOST).


He has undertaken major research projects through the Department of Science and Technology, (Under Nano Mission), Ministry of Human Resources Development, Punjab State council for Science and Technology, Chandigarh Regional Engineering College, Jalandhar etc.

He has published numerous papers in international journals published by ELSEVIER, Taylor & Francis and has contributed more than 50 articles in national journals. He has written book chapters in publications brought out by Springer. He has also presented many papers in international and national conferences.

His research interests include areas such as Nano Composites, Nano Surface Chemistry, Nano Environmental Chemistry and Micro Pollutants, Natural Products Chemistry, Surface Active compounds and their Characterization.

He is a distinguished Life Member in Indian Society for Surface Science and Technology, Calcutta, Indian Thermal Analysis Society, BARC, Mumbai, Indian Council of Chemists, Agra, Indian society for Technical Education, New Delhi, Hindi Vigyan Sahitya Prishad, BARC, Mumbai, Him Science Congress Association (HSCA), Journal of Environmental Research and Development (JERAD), Association of Chemistry Teachers.

He is a Reviewer of International Journals such as Materials Science and Engineering, Journal of Hazardous Materials, Construction and Building Materials (Elsevier), International Journal of Environmental Science and Technology, Desalination and Water Treatment (DWT), Indian Journal of Chemical Technology NISIR CSIR New Delhi, Materials and Design (Elsevier). He



is a member of editorial board of the International Journal of Theoretical & Applied Sciences and The Holistic Approach to Environment.

On academic assignments, he has various universities and institutions and delivered lectures widely in countries such as Mauritius, Greece, Egypt , Malaysia and USA. He has delivered invited talks and guest lectures in more than 40 institutions across the country and has chaired many sessions besides being a member of coordination committee and jury member.



Dr. Sangita Kalarickal, Ph.D.

Senior Staff Engineer
Data Analytics and Modeling,
Seagate Research Group
Shakopee, Minnesota, USA

Dr. Sangita Kalarickal is a Senior Staff Engineer in the Data Analytics and Modelling at Seagate Technology, Minnesota, USA.

She acquired her Ph.D. at Colorado State University and pursued Post-doctoral research at Colorado State University. She completed her Masters' degree from the University of Mumbai, India.

Previously she worked as a Recording Physics Engineer at Seagate Technology, USA and as Adjunct Assistant Professor at the Department of Physics and Energy science at the University of Colorado at Colorado Springs. She has experience with academic research laboratories, having worked as Research Scientist at Freie Universität, Berlin, Germany and at Colorado State University, Colorado, USA. She was also served as a lecturer at H.R. College, Mumbai, India.

Her expertise lies in the fields of ferromagnetic relaxation, interlayer exchange coupling, and spin dynamics in thin films and ferromagnetic nanostructures. Her areas of research interests include External Storage, Internal Storage, Cloud Storage, Small Business Storage, Portable Storage, Networking, Home Entertainment, Storage Solutions, Data Recovery, Data management, Big data, Data storage.

She is a Senior Member IEEE in India.

Prof. B. S.Kaith

Professor

Department of Chemical Engineering,
NIT, Jalandhar, Punjab

Professor Balbir Singh Kaith joined NIT Jalandhar in 2007 as Professor of Chemistry. Before joining NIT Jalandhar he served NIT Hamirpur for about 16 years. He was Head of Chemistry Department from September 2009-2012 and January 2019 to February 2021. He also served NIT Jalandhar in the capacity of Dean Planning & Development, Registrar, Dean Students Welfare and Dean Academic. Professor Kaith is HAG (Higher Administrative Grade) Professor. In the recent survey conducted by Stanford University, US, Professor Kaith has been ranked among the top 2% Scientists of the World (data has been published in highly reputed International Journal PLOS BIOLOGY).

Presently his research group is working on Smart Materials and their applications in sustained / controlled drug delivery systems, controlled release of agrochemicals, removal of toxic dyes and heavy metal ions from the waste water etc. He is also working on Modification of Fibres through Graft Copolymerization and Nanogel Composites.

He has published more than 250 research papers in International journals of repute (SCI & Scopus). He has produced 25 PhD students and 04 are in pipe line. His citation Index is: Citations = 7589, h-index = 41 and i10-Index = 139.

He is the recipient of ICC award 2018, NIT Jalandhar Best Teacher Award 2018, HIM Science Congress Fellow of the year Award 2013-2014, NIT Hamirpur Commendation Award 2003. ICAS-New Delhi Chapter (IOC) Excellence in Science Award.

In addition his research group got Golden paper award, Young Chemist Award, Young Scientist Awards and Best Paper Awards.



Dr. Vinay Sharma

Post-Doctoral Researcher
Morgan State University
Baltimore, Maryland, USA

Dr. Vinay Sharma obtained his PhD from Jawaharlal Nehru University in Magnetic Nanostructures fabrication and device designing and is presently pursuing his Postdoctoral Researcher at the Morgan State University, Baltimore, Maryland. He is currently working Dixon Research Centre Department of Physics with primary focus on the fabrication of magnetic and Dirac metals heterostructures and their RF applications.

He was previously a Junior Research Fellow in the Defence Research Development Organisation. He has obtained Licenses & Certifications in Hardware of a Quantum Computer, Architecture, Algorithms, and Protocols of a Quantum Computer and Quantum Internet, Quantum Computing & Quantum Internet

He has expertise in synthesis and characterization magnetic nanomaterials specially nanoparticles and thin films, microwave magnetics and has designed several microwave measurement setups and techniques. He is currently gaining expertise in the field of spintronics based device fabrication and testing.

He has published several of his research works in internationally reputed journals brought out by Institute of Physics, Elsevier, IEEE and American Institute of Physics and Nano technology world association etc.

He has undertaken major projects on designing and fabrication of magnetic field tunable microwave devices for spintronics applications.

He has professional associations with organizations such as the American Physical Society, Society of Physics Students. His hobbies centred on activities of Electronics, Space Electronics, Quantum Physics

Dr. Uma Shanker

Assistant Professor
Department of Chemistry
Dr. B.R. Ambedkar National Institute of Technology,
Jalandhar

Dr. Uma Shanker is currently an Assistant Professor in the Department of Chemistry at the Dr. B. R. Ambedkar National Institute of Technology, Jalandhar. He pursued B.Sc and M Sc in Organic Chemistry from the University of Lucknow and obtained his Ph.D from the Indian Institute of Technology, Roorkee

His major research areas include Environmental Nanotechnology, Green Synthesis of Nano-structured materials, Nanocomposites, Exploration of Photocatalytic properties of nanomaterial's, Size and shape dependent properties of nanoscale materials, Applications of Nanomaterials in environmental remediation

He has undertaken various Research Projects with funding from IUAC New Delhi, TEQIP-II and NIT Jalandhar.

He has to his credit published over 65 Journal publications in popular international scopus indexed journals, contributed 14 book chapters and has authored 4 books as the Chief editor published by Elsevier, Springer nature and Taylor& Francis besides publishing more than 60 conference publications and conference presentations. He has organised and coordinated various short-term courses, international conferences and workshops.

He has developed various courses in Advanced Organic Chemistry at M Sc level and Green Chemistry at M Sc&Ph D levels and has rendered guidance to 6 PhD candidates and has guided several M.Sc projects and supervised candidates.

He bagged various awards such as the Annual Member of Indian Council of Chemist, CSIR (UGC)- JRF in Chemical Sciences, GATE- Chemistry, and the DST travel grant to attend International Conference in Greece, 2011. He presented the best paper award by the Asian Society of Research.

He has memberships in various professional bodies such as the American Chemical Society, Association of Chemistry Teachers, HIM Science Congress and Indian Science Congress Association.

Dr. A. Chandra Bose

Professor

Department of Physics

National Institute of Technology

Tiruchirappalli, Tamil Nadu

Dr. A. Chandra Bose joined the Department of Physics at National Institute of Technology - Tiruchirappalli from the year 2006 and currently serves as Professor in the Department.

He received his Ph.D in the area of nanocrystalline materials from University of Madras. He pursued his post-doctoral research at the Nanomaterials Laboratory in National Institute for Materials Science (NIMS), Tsukuba, Japan and later pursued another post-doctoral research at the Research Centre in National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan, besides, working as a Senior Research Fellow in the CSIR and as Research Scientist in a DST project at the University of Madras.

He has undertaken various research projects sponsored by the DST, NRB - DNRD, DST - Nano Mission. He has guided 11 PhD scholars besides guided 47 M.Sc./M.Tech students to complete their projects. His current undertaking extensive research studies on the synthesis and characterization of oxide nanoparticles, Supercapacitors, Photoluminescence and Photocatalysts.

He has published over 120 research publications in leading international and national journals of high repute, presented more than 110 papers in international /national conferences, besides publishing 31 presentations in international/national conference proceedings. He has also delivered invited presentations, keynote talks and seminars across the country and abroad.

His research interest include nano-material for clean environment and sustainable energy conversion and storage applications, metal oxides, perovskite oxides, and 2D materials for photocatalysis, electrochemical capacitors, and solar cells.

He was bestowed the Young Scientist Award (Travel grant) to visit the International School on powder diffraction. He has secured several other awards and recognitions by the Indian Association for the Cultivation of Science, CSIR, Young Scientist Award by the Department of Science and Technology, Government of India, Best Teacher Award by NIT, Young Achiever Award in the DAE Symposium besides various visiting professorships.

He has undertaken academic visits to Institute of Nanotechnology, Karlsruhe, Germany and Nanoarchitectonics Centre, NIMS, Japan. He has chaired sessions in ICEAN -2012 at Brisbane, Australia besides chairing various sessions in other academic fora. He is a lead member in various professional bodies such as the Materials Research Society of India, Physics Association and the Indian Society for Non Destructive Testing.



Dr. Stephanie Hernandez

Seagate Research Group
Shakopee, Minnesota, USA

Stephanie obtained her undergraduate degree in Electrical Engineering at the University of Turabo in Puerto Rico in 2004. She then moved to Minnesota to pursue a graduate degree, also in Electrical Engineering at the University of Minnesota. After completing her graduate research, which involved modeling magnetic recording media and spin-torque based structures, she was awarded a Ph.D. in 2010.

After graduate school, she started working for Recording Head Operations at Seagate Technology in Bloomington, Minnesota as a read transducer designer. In 2015, she joined Seagate Research in Shakopee Minnesota to model advanced Heat Assisted Magnetic Recording. She is now manages the System Modeling and Data Analysis group at Seagate Research, which is responsible for performing drive level experiments to elucidate critical recording processes, as well as modeling the Seagate HDD Roadmap.

Stephanie is one of people leading the modeling effort at Seagate, collaborating with many groups worldwide to develop and improve the models and simulation tools used to design the hard drives of the future. She received an Outstanding Technical Contributions Award from Seagate, given in Fiji in February of 2018, and was inducted into the Seagate Innovators Circle in November.

Dr. S. Manivannan

Associate Professor
Department of Physics
National Institute of Technology
Tiruchirappalli, Tamil Nadu

Dr. S. Manivannan received his Ph.D., from Bharathidasan University, Tiruchirappalli and completed postdoctoral research in the Department of Information Display & Advanced Display Research Center, Kyung Hee University, Seoul, South Korea. He joined as a faculty in Department of Physics, National Institute of Technology, Tiruchirappalli on December 2008.

His research areas of interest include carbon nanotubes, graphene, graphene oxide, transparent conducting films and devices, gas sensors, organic/semi-organic nonlinear optical (NLO) materials and polymer nanocomposites.

To his credit, Dr. Manivannan published about 48 papers in peer reviewed international journals and 62 papers in national/international conference proceedings/abstracts and successfully completed a sponsored research project. Currently, he has two sponsored research projects from CSIR and DRDO, India and filed two Indian patents.

He also received Junior and Senior Research Fellowships from DST and CSIR. He is the recipient of Brain Korea postdoctoral fellowship. He won many best paper awards, notably from European Materials Research Society, session's best presentation award from International Conference on Nanoscience and Nanotechnology at Colombo, Sri Lanka, IUMRS-ICYRAM 2016 at IISc, Bangalore.

He has been honored with "Faculty Achiever's Award" at NIT, Tiruchirappalli in the year 2017 and with "Tamil Nadu Young Scientist Award for the year 2016" in the discipline of Physical Sciences.

He acquired American Society for Nondestructive Testing (ASNT)- Level -2 certification in Ultrasonic Testing. Dr. Manivannan has so far guided two Ph.D, 28 M.Tech, 15 M.Sc and 01 M.S (by research) students for their projects. Currently 04 Ph.D students are working under his guidance.

He has organized over 07 conferences/workshops/courses at NIT Trichy. He is the member of Indian Society for Non-destructive Testing, Photonics Society of India, SPIE-USA and International Association of Advanced Materials.

Dr. Manivannan has travelled extensively, interacted with experts, and participated in various academic programmes in South Korea, Japan, Poland, United States of America, Singapore, China, Sri Lanka and delivered invited talks extensively in higher educational institutions in these countries. He is serving as reviewer in many international journals.

Dr. Vijay Karthik Sankar

Manufacturing Engineer at First Solar Inc., USA &
Formerly Researcher at Seagate Technology

Dr. Vijay Sankar obtained his Ph.D in Materials Science Engineering from the National Institute for Materials Science (NIMS) affiliated to Graduate school of pure and applied sciences at University of Tsukuba, Japan. He pursued M.E in Metallurgical Engineering from the Indian Institute of Science and Bachelor's degree in Metallurgical Engineering from the NIT Jamshedpur.

He served as a post-doctoral researcher at the University of Notre Dame, Indiana, USA, University of Alabama, USA and National Institute for Materials Science, Ibaraki, Japan.

He has acquired expertise as manufacturing engineer in improving quality, profitability and processes in manufacturing industry. He has speciality in materials design, DOE, process development, SPC, FMEA, failure analysis, R&D of novel multidimensional materials for Industrial applications as a versatile advanced materials engineer. His expertise lies in the areas of Thin film technology: RF and DC sputtering, CVD, PLD, PVD, Evaporation. He is conversant with the characterization tools and transport and magnetic measurements.

At First Solar, Ohio, as Manufacturing Engineer he has delivered significant tool availability improvement (>0.8%) globally by reducing the metrology sample frequency using statistical tools resulting in huge cost saving. He is the tool owner for 2 manufacturing lines (over 3 million products per year) and maintained tool availability of about 80%, yield of over 99%, and all production metric goals. He has immensely contributed to WDXRF measurement tool ownership responsibilities for 24x7 production support to control critical KPOVs, GRR analysis, SPC charts.

At Seagate Technology, Minnesota, he contributed to the improve the reliability, wear & tear by 1000% and overall performance of HDD read heads by developing novel adhesive materials. He was instrumental in development of first generation HAMR product successfully with 99% process yield and established the GRR, SPC charts for production support. He has performed extensive DFMEA, DOE, documented the best practices, FMEA analysis for global manufacturing besides developing ultra-low shield-to-shield spacing read-head sensors for second generation HAMR product.

He also specializes in Machine Learning. He has professional affiliation as senior member with organisations such as IEEE, The Minerals, Metals & Materials Society, Spintronics Interest Group, IEEE Magnetics Society, Semiconductor Manufacturing, Entry Level Engineers and Thin Film Energy Storage and Transfer.

Short-term Certificate Course
On
NANO Technology & Its Applications
(An Industry & Institute Partnership Program)
(April 26-30, 2021)

**ORGANISED
BY**



RAJIV GANDHI NATIONAL INSTITUTE OF YOUTH DEVELOPMENT
Institution of National Importance by the Act of Parliament No.35/12
Ministry of Youth Affairs and Sports, Government of India, Sriperumbudur – 602 105

IN ASSOCIATION WITH

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Programme Schedule

Day 1: April 26, 2021 (Monday)

Mode of Program: Virtual

Time 11.00 – 11.30	Inaugural Programme	Minute to Minute Program
	Welcome address and Program Briefing by Prof. Sibnath Deb , Director, RGNIYD, MYAS, GoI	3 minutes
	Introduction to the Program and Its Objectives by Prof. S. K. Sinha , NIT, Jalandhar	2 minutes
	Address by Prof. Lalit Kumar Awasthi , Director, NIT, Jalandhar	4 minutes

Address by Prof. Mini Shaji Thomas , Director, NIT, Tiruchirapalli	4 minutes
Address by Dr.V.Veera Kumar , Former Scientist, R&D, Seagate and Engineering Manager, Boston Scientific, Arden Hills, Minnesota, USA 55315	3 minutes
Address by Prof.Bijoy Kumar Kuanr , Chairperson, Special Center for Nano Sciences, Jawarhalal Nehru University, New Delhi	3 minutes
Address by Shri. Asit Singh , IRS Joint Secretary (Youth Affairs), MoYAS	4 minutes
Presidential Address by Ms. Usha Sharma , IAS Secretary (Youth Affairs), MoYAS, Government of India	6 minutes
Vote of thanks by Prof.K.S.Ravichandran , Registrar, RGNIYD	2 minutes

Technical Sessions

11:30 am – 1.00 pm	Nano Technology and its Applications	Prof.Bijoy Kumar Kuanr Chairperson Special Center for Nano Sciences, Jawarhalal Nehru University, New Delhi
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Lunch Break

Time	Title of the Session	Resource Person
2:00 pm - 3:30 pm.	Emerging Applications of Magnetic Nano Particles	Dr. R. Justin Joseyphus Associate Professor Department of Physics National Institute of Technology Tiruchirappalli, Tamil Nadu

Day 2: April 27, 2021(Tuesday)

10.00 am – 11:15 am	Nanotechnology for High Frequency and Medical Device Applications	Dr.V.Veerakumar Center for Magnetism and Magnetic Nanostructures, Department of Physics, University of Colorado, Colorado Springs, Colorado, USA
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11.15 am – 12.30 pm	Nanomaterials as Photocatalysts	Dr.K.N.Sheeba Associate Professor Department of Chemical Engineering National Institute of Technology Tiruchirappalli, Tamil Nadu
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Lunch Break

2:30 pm – 4:00 pm	Carbon Nanomaterials and their Role in Improving Physico Chemical Properties of Cement Matrix Tailored to Civil Engineering Applications	Dr. N. C. Kothiyal Professor and Head Department of Chemistry NIT-Jalandhar, Punjab
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Day 3: April 28, 2021 (Wednesday)		
10.00 am – 11:30 am	Heat Assisted Magnetic Recording - The Future of Information Storage - I	Dr.SangitaKalarickal, Ph.D. Senior Staff Engineer Data Analytics and Modeling, Seagate Research Group Shakopee, Minnesota, USA
11:45 am - 1:15 pm	Scope of Nanomaterials for Environmental Applications	Dr. M. Matheswaran Associate Professor Department of Chemical Engineering National Institute of Technology Tiruchirappalli
Lunch Break		
2:30 pm – 4:00 pm	Designing of Eco-Friendly Interpenetrating Smart Materials – Applications in Different Fields	Prof.B.S.Kaith, Professor, Department of Chemical Engineering, NIT, Jalandhar, Punjab
Day 4: April 29, 2021 (Thursday)		
10.00 am – 11:30 am	Nano Heterostructures for RF Applications	Dr. Vinay Sharma Post-Doctoral Researcher Morgan State University Baltimore, Maryland, USA
11:45 am - 1:15 pm	Green Synthesized Nanomaterials for Water Pollutants Removal	Dr.Uma Shankar Professor, Dept. of Chemistry NIT-Jalandhar, Punjab
Lunch Break		
2.00 pm to 3.30 pm	Nano Materials for Energy Applications	Dr. A. Chandra Bose Professor Department of Physics National Institute of Technology Tiruchirappalli, Tamil Nadu
Day 5: April 30, 2021 (Friday)		
10.00 am – 11:30 am	Heat Assisted Magnetic Recording - The Future of Information Storage - II	Dr.StephanieHernandez Seagate Research Group Shakopee, Minnesota, USA
11:45 am - 1:15 pm	Nano Applications in Hardware Design	Dr.S.Manivannan Associate Professor Department of Physics National Institute of Technology Tiruchirappalli, Tamil Nadu
Lunch Break		
2:00 pm – 3.15 pm	Nanostructured Devices for Magnetic Storage Applications	Dr. Vijay Sankar (Former Researcher at Seagate Technology) First Solar Inc. Perrysburg, OH, USA

3.15 pm - 3.20 pm	Online Feedback
3.20 pm - 4.00 pm	<p>Valedictory Program</p> <ul style="list-style-type: none"> ▪ Prof. Sibnath Deb, Director, RGNIYD ▪ Prof. S. K. Sinha, Dean, NIT, Jalandhar ▪ Prof.Prof. Bijoy Kumar Kuanr, Chairperson, Special Center for Nano Sciences, Jawarhalal Nehru University, New Delhi ▪ Dr.V.Veerakumar, USA ▪ Prof.K.S.Ravichandran, Registrar, RGNIYD

List of Participants

S. No	Name of the Participant
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2	Jithendra Kumar
3	318107121020 Andhra University
4	1641029 Atharv kulkarni
5	1842102_Awes_Khan
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7	2G I Macmin juan
8	38.Deepthi. A
9	3D Electronics
10	A.H.D.Prakash
11	A.Heera Durga Prakash
12	Aadil Hassan
13	aarti lakhara
14	Aashritha
15	Aasi Fa
16	aasim rashid khanday
17	Abdul Waheed
18	Abdullahi Omar Abdullahi
19	Abhiram
20	Abhishek Sharma
21	Aditya
22	Aditya Kumar
23	Aditya kumar jha
24	Afra
25	Afroz Begum Mohammad
26	aftab
27	Agney Praseed
28	Ahanger Safeena Majeed
29	Ajay Kumar Jha
30	Akash Atkal
31	Akshaya
32	Akshaya deepika kunche
33	Akshaya Patchigolla
34	Alam Akhoon
35	Alapati Tejoamareswar

36	Alla Padmakar
37	Ambigadevi J
38	Anand Bharti
39	Ananda Murugan P
40	Anandkumar Mariappan
41	Anantharam Vemuri
42	Anil Jogdand
43	Anita Chetry
44	Anjali Agrawal
45	Ankit Dixit
46	Anubhav Pandey
47	Anurag Kumar
48	Apoorva J R
49	Appikonda Jigisha
50	Arathy M
51	Archita Gupta
52	Arpita Sarkar
53	Arpith Pradeep Kumar
54	Arun Justin
55	Arun Pravin
56	Arunabh Dihingia
57	Asem Vikash Meitei
58	Ashwani Kumar Mishra
59	Asif Majeed
60	Aswathi M
61	Aswitha
62	Atharv kulkarni
63	Atul Ranjan
64	Aurobind Ganesh
65	awab
66	Ayushmaan
67	B Srilekha
68	Badireddy Jithendra Kumar
69	Basanta
70	bavana biddala
71	Bendangkokba
72	Bevara Raviteja
73	Bhagyashree
74	Bhagyasree De

75	bhanu
76	Bhargavi Vemulavada
77	bhaskar ahuja
78	Bhavesk kumar
79	Bhavika Chouhan
80	Bhavitha Sri
81	Boateng Derrick
82	Bojja Sudhamai
83	Buddha Dev
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96	Dasari Viswanadham
97	David Paul
98	Debashish Talukdar
99	Debi Murmu
100	Deepa Bedi
101	Deepak Saikia
102	Deepika Biswas
103	Deepika Vemuri
104	Devangam Ramakrishnagari Thejesh
105	Devi Vara Prasad H
106	Dhakshina Moorthy C J
107	Dheeraj Chamoli
108	Dhruthi BVS
109	dileep prasad
110	dinavahi leela vivek
111	Dipanwita Chakraborty
112	divya kurimilla
113	Dr Asem Bimola Devi

114	Dr Muankimi
115	Dr. Ajay Kumar
116	Dr. G. Saravana Kumar
117	Dr. Leimapokpam Dorendro Singh
118	Dr. M Infant Shyam Kumar
119	Dr. Sajad Hussain Din
120	Dr. Vanlalhrui Ralte
121	Dr.G.Carlin Geor Malar
122	Dr.S.Girisankar
123	Dungala Simhachalam Naidu
124	Duvvara Bhavana
125	Dwarakanath Dey
126	E Ravichandran
127	Edubilli Surya
128	Elakkiya
129	Esinasi Rajesh
130	Fabian Dhar
131	Fireflies.ai Notetaker Santhos
132	firoj pradhan
133	Flavio Domingos Jorge
134	G K Karthik
135	Gabriel
136	Gampa.sowmya
137	Gandham.Tirumala Siva Pavan
138	Gantala Sarva Sai Nikhilesh
139	Ganti Venkata Sai Subhash
140	Gaurav Agarwal
141	Gaurav Bassi
142	Geetha Chandrasekran
143	Gokulan M
144	Golagani Mytri Sukkumari
145	Golli. Ramya
146	Gopal Singh
147	Gottipati Dedeepya
148	Gowher Hameed Rather
149	Gowthami Pachila
150	Guddu Kumar-19 (CE)
151	Gunna Deekshita
152	Gurijala Pavan Kumar

153	Gurmeet Singh
154	gursimran
155	Haider Hugo Remane Dos Reis
156	Hannah Agnes
157	Haopu Haokip
158	Hari Teja Redrouthu
159	Hariharan.S
160	harini
161	Harpreet Singh Bedi
162	Harsh Sharma
163	Harshitha
164	HarshithaRani Bariki
165	Hem Prakash Verma
166	HimaBindu
167	Himalda Francina
168	Himanshu Pachori
169	HP
170	Hreetabh
171	Ibopishak Singh
172	Imteyaz hussain khan
173	indu
174	Infant Shyam kumar
175	Infant Shyam Kumar M
176	Insha
177	Islavath Suresh Naik
178	james
179	janapareddi sravan kumar
180	Jaswanth Padala
181	jawad
182	Jayalakshmi
183	Jayalakshmi Harikrishnan
184	Jayasree Venkata Rajyalakshmi Petchetti
185	jennifer
186	Jeremiah Sunadh
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188	Jitray Tudu
189	joel
190	joshua kumar
191	joy

192	Julakanti sujith
193	K.Seethalakshmi
194	K.Sravya
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198	Kakara Sujay Raj
199	Kambham Sri Lekha
200	Kancharana Suresh Kumar
201	Kanhaiya Kumar
202	KanupriyaVarshney _
203	karri deepak
204	Kaushalya Dehury
205	Keerthana
206	Keerthana Urukuti
207	kevin mathew
208	Khakshiya Ganesan
209	Khan Tafazzalat ul Islam
210	kirti
211	KK Pavan Kumar
212	Kokkiligadda Jhansi
213	Kowsar Ali Mir
214	Krishna Nagarjuna Medidi
215	Krishnananda C P
216	kudumi katei
217	Kunibelli Delleswar Pavan Teja
218	Lahari
219	lakavath vaniramulu
220	Lakkaraju Nageswara Rao
221	Laksheswari Nayak
222	Lakshman Rao Lingala
223	Lakshmi Manasa dolai
224	Lakshmi prasanna
225	lakshmi prasanna katadi
226	Lanchungliu Gonmei
227	lasina Jarajana
228	Lekhamooe Albert kekele
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233	M Vignesh
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239	Madina. srilekha
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241	Mahesh Samant
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244	Malla Nandini Sai
245	Mamina Kuanr
246	Manasa
247	Manasi Esther
248	Maneesh
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252	manoj kumar
253	Mantu meher
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255	Mashooq
256	mayank kabra
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259	ME20B1022 Saranya M
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261	Meghana Peyyala
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263	Mirothali Chand C
264	Mohamed Mashooq
265	Mohamed Osman Farah
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267	Mohammad Sadik Ali
268	mohammed mansoor
269	Mohammed Saeed

270	Mohammed Zahid
271	Mohd Ashraf Shah
272	mounika
273	Muankim-i
274	Mudit Pandey
275	Muhammad Ashraf
276	mukesh
277	mukesh Kumar parha
278	Munna Kumar
279	musinana prasanth
280	mythely
281	Naga Harshitha
282	Nagarajan
283	Nagarajan Krishnan
284	Nakka Vivekananda
285	Nangki Tagi
286	Naralchitti Umesh
287	NARENDRA
288	Naresh Babu Polavarapu
289	Naresh Sharma DYC Dharamshala
290	naveen kumar
291	Naveen Kumar kudipudi
292	navya
293	Nayab Rasul Shaik
294	Neeraja Siriki
295	Nengneithem Touthang
296	Nikhil
297	Nikhilesh Kumar Dilwaliya
298	Niraj Kumar Singh
299	Nithish Reddy
300	Nitish Mishra
301	Nuthalapati Karunya
302	p hemanth sai
303	Palavalasa Srihari
304	Pamleiphy Shangh
305	Pankaj Khemani
306	Pappu Sateesh
307	parisha
308	Partha Pratim Goswami


309	Passang Drema
310	Paul
311	pavan
312	Peddi Sai Mounika
313	Pediredla Chaitanya
314	pediredla chaitanya
315	Pema Yangzom
316	Pericharla Varun Raju
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318	Phani Met
319	pothula bhashmika
320	Potta Venkata Padma Gayatri
321	Pragna
322	Prajwal
323	Pranavi
324	Prasanna Devi Achanta
325	Prasanth
326	Prasanth G
327	Prashant Kukreti
328	Pratap satya
329	prathyusha
330	prati
331	Pratika Satya Dasareddy
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333	Pritham Raj kutcherlapati
334	priyanka
335	Priyanka Chouhan
336	priyanka.s
337	puli ektha
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342	Radhika Kuracha
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347	Raja muthuramalingam

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363	Ravi
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371	Ramkumar
372	ridwan mohamed abdulah
373	Ringchamdinliu Ngaomei
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377	Rohith.s
378	Rubana Shaik
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380	Rupesh Kadhao
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391	Sagar Baitule
392	Sahidh Khan
393	Sai Charan Kudama
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395	Sai Kiran
396	sai prakash
397	Sai Sruthi
398	sairam seetharam
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400	Sakra Beshra
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403	samatthuvan
404	Samatthuvan
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408	Samuel Suraj
409	sanapala kurmikadevi
410	Sandeep Kumar
411	Sandrana Niharika
412	Sange Dondu
413	Sangeeta Parida
414	Sangharatna R
415	Sanjay Kumar Mehta
416	Sanjeeta Rani
417	Sanjiv Kumar Tiwari
418	santhosh
419	Santhosh Kumar P
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423	Saravanan C
424	Satarupa Pattanayak
425	Sathya.K

426	Saurabh Yadav
427	Saurav Majumder
428	Sauravh Yadav
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437	Shayesta Ali
438	Shiva Kumar
439	Shivam Shankar
440	Shivam shankar
441	shivani Devi
442	shivankar
443	Showket Bhat
444	Shravya. G
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446	Shubham Kumar Dubey
447	Shubhi Raj Singh
448	Shweta Karodiya
449	Shweta Saini
450	Shyam Sundar Pati
451	Sibi Raj.P
452	Siddharth Parihar
453	Siddhartha Kadiri
454	Simran Baweja
455	Simran Kaur Sidhu
456	Sindhu
457	sistu. sri devi
458	sivaram
459	Snigdharani Panda
460	Sonali
461	sourabh joshi
462	Sourabh Rathor
463	Sravan Kumar
464	sree lahari

465	Sreenath Dey
466	Sri Sindhu Gudipati
467	Sri Sravisht Kancharla
468	Srikar Madhunapantula
469	SriKeerthi Rokkam
470	Srinivas Ponnada
471	Srinivasan
472	Srujana
473	Srujana Gudivada
474	Srujana Pillay
475	Srujana Ragala
476	subhashini
477	Subhendu Bera
478	sujanapriya saga
479	sukh sagar
480	Sukriti Hans
481	Sulekha Kumari Pandit
482	Suman Gandhi
483	Sumit Kumar Jana
484	Sundaramoorthy K
485	Sunil Kumar
486	Sunkavalli Sai Prakash
487	Suraya
488	Suresh Chandra Baral
489	surisetti lavanya
490	Sushmitha Kali
491	T Amisha
492	T Athul
493	Talari Hari Krishna
494	Tanuja Tanu
495	Tanya kaur
496	Tasleema Iqbal
497	Tausif Ansari
498	Thiyagarajan Radhakrishnan
499	Thiyagarajan Radhakrishnan
500	Thota Revanth Krishna Sai
501	Tsering wangmu
502	Uday Pavan
503	Umer Ahmad Bhat



504	umesh N
505	Umesh S
506	Urukuti Keerthana
507	utkarsh
508	Vaibhav Sanap
509	Vara Valankani Vijaya Sagar
510	Varshitha Baki
511	Vemavaram Divya Sravanthi
512	Vemulavada Bhargavi
513	Vidadala Siri Hanuma
514	Vidhya Sree
515	Vinayaka D Rao
516	Vinoth Babu
517	Vivek
518	Vivek ananda
519	Vivek vikram
520	Vrushank Vommi
521	Wasim Akram
522	WorkLAB
523	Yamuna Naramsetti
524	yarlagadda madhuri
525	Yarrabolu Siva
526	Yash Raj Rastogi
527	Yellareddy Varshanth Reddy
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**Short-term Certificate Course
On
NANO Technology & Its Applications**
(An Industry & Institute Partnership Program)

(April 26 - 30, 2021)

ORGANISED

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Rajiv Gandhi National Institute of Youth Development (RGNID)
(Institution of National Importance by the Act of Parliament No.35/2012)

Ministry of Youth Affairs and Sports, Govt. of India
Sriperumbudur, Tamil Nadu
in association with



National Institute of Technology, Jalandhar
National Institute of Technology, Tiruchirappalli
Jawaharlal Nehru University, New Delhi
Seagate Technology, Minnesota, USA



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Dr. Mini Shaji Thomas
Director, NIT
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Prof. Bijoy Kumar Kuanr
Chairperson
Special Center for Nano Sciences
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(Former Scientist, R&D, Seagate)
Engineering Manager,
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Arden Hills, Minnesota, USA

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Professor, NIT Jalandhar



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Professor, NIT Tiruchirappalli



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Associate Professor, NIT Tiruchirappalli



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Dr. Sank
Associate Professor, NIT Jalandhar



Dr. K.N. Shrivastava
Associate Professor, NIT Tiruchirappalli



Note :

No Registration Fee. E-certificate will be issued to all the participants subject to attendance of all the sessions.

DATE : April 26 - 30, 2021

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