Webinar
Faculty Development Programme, Department of Physics and Nanotechnology
SRM Institute of Science and Technology, Chennai
09-07-2020 – 18-07-2020

Day 1: Thursday, 09 July 2020, 09.40 am to 11.00 am

Prof. Pratibha Jolly
FNASc, FInstP (IoP, UK)
Academic Consultant, NAAC
Former Principal, Miranda House, University of Delhi

Title: Revitalizing Physics Education at the Tertiary Level

Dr. Pratibha Jolly served as Principal, Miranda House, premier college for women at the University of Delhi, a post she held for fourteen years from April 2005 till February 2019. Under her dynamic leadership, Miranda House received All India Rank One under National Institutional Ranking Framework for three successive years in 2019, 2018 and 2017. It is a measure of the strong foundations laid by her that NIRF 2020 again ranked the college on the top.

Dr. Jolly has wide-ranging synergetic contributions. She is passionate about engendering change, early adoption of new technologies, faculty development, capacity building of women in science and leadership roles, entrepreneurial activities, mentoring diverse student populations, creating a technology-enhanced active teaching-learning environment, promoting project-based learning, interdisciplinary undergraduate research and helping students build successful careers.

Dr Jolly stressed the importance of 6D's of exponential technology transformation such as digitized, deceptive, disruptive, demonetized, dematerialized, democratized in the higher education system during her talk in the faculty development program. She also talked about the influx of new pedagogical methods and diffusion of innovation in teaching to enable student-teacher learning mutually beneficial with thinking curriculum, thinking teacher, and thinking student. She specifically mentioned that faculty members should have hands-on, hearts-on, and minds-on approach in teaching to the UG and PG students.

Prof. Kathigeyan introduced the speaker and moderated the session. The HOD Dr. Krishna Mohan addressed the welcome note and vote of thanks.

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Day 2: Friday, 10 July 2020, 09.00 am to 11.00 am

Prof. Chandralekha Singh
President, Am. Assoc. of Phys. Teachers
University of Pittsburgh, USA

Title: Helping students learn quantum mechanics using research-validated tools

Chandralekha Singh is a professor in the Department of Physics and Astronomy and the Founding Director of the Discipline-based Science Education Research Center (dB-SERC) at the University of Pittsburgh. She is currently the President of the American Association of Physics Teachers. She obtained her B.Sc. and M.Sc. from the Indian Institute of Technology Kharagpur and her Ph.D. in theoretical condensed matter physics from the University of California Santa Barbara. She was a post-doctoral fellow at the University of Illinois Urbana Champaign, before joining the University of Pittsburgh. She has been researching physics education for more than two decades. She co-led the US team to the International Conference on Women in Physics in Birmingham, UK, in 2017. She is a Fellow of the American Physical Society, American Association for the Advancement of Science and American Association of Physics Teacher.

Learning quantum mechanics is challenging. To help improve student understanding of quantum mechanics concepts, she has been conducting the investigation of the difficulties that students have in learning quantum mechanics, and she is using research as a guide to developing Quantum Interactive Learning Tutorials (QuILTs) as well as tools for peer-instruction. The goal of QuILTs and peer-instruction tools is to engage students in the learning process actively and to help them build links between the formalism and the conceptual aspects of quantum physics. These learning tools focus on helping students integrate qualitative and quantitative understanding without compromising technical content. Prof. Chandralekha discussed a framework for understanding students' difficulties in quantum mechanics and gave examples of how research-validated learning tools and pedagogies can help students develop a good grasp of quantum mechanics.

Dr. Abhay Sagade introduced the speaker and moderated the session. The HOD Dr. Krishna Mohan addressed the welcome note and vote of thanks.

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Day 3: Monday, 13 July 2020, 09.30 am to 10.30 am

Prof. S.V.M. Sathyanarayana

Pondicherry University, India

Title: Statistical Mechanics for Scientists and Engineers

Prof. Satyanarayana introduced the Statistical Mechanics for the faculty of the Department of Physics and Nanotechnology. He started asking a question. If we took a coin and tossed, what is the outcome?. Then he started explaining the methods of teaching statistical mechanics, and it was informative, and faculty members interacted with him well at the end of his session.

Dr. Kamala Bharathi introduced the speaker and moderated the session. The HOD Dr. Krishna Mohan addressed the welcome note and vote of thanks.

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Day 4: Tuesday, 14 July 2020, 09.30 am to 11.00 am

Prof. G. P. Das
IIT, Kharagpur, India

Title: Teaching Physics of Materials: from Concepts to Happenings

Prof. G.P. Das is a solid-state physicist cum materials scientist, currently working as a Visiting Professor in the Indian Institute of Technology (IIT) Kharagpur where he is associated with the Dept. of Metallurgical & Materials Engineering jointly with the Dept. of Physics and the School of Nano Science & Technology. Prior to this, he served as a senior professor in the Indian Association for the Cultivation of Science (IACS) Kolkata and as a senior scientist in Bhabha Atomic Research Centre (BARC) Mumbai. He has published over 150 original research papers in international journals and book chapters in diverse areas such as alloys, intermetallics, etc. Apart from this, he has delivered invited talk in more than 100 international conferences all over the world. He served as a visiting scientist in several institutes abroad viz. Max Planck Institute Stuttgart (Germany), Virginia Commonwealth University, Richmond (USA), Institute of Materials Research, Sendai (Japan), University of New South Wales (Australia). Prof. Das is well known for his passion for delivering lectures for students, faculties, and researchers at various levels.
In his talk, Prof. G. P. Das talked about Physics of Materials, variedly known as Solid State Physics or in a broader perspective as Condensed Matter Physics (all essentially denoting the same sub-field of Physics) is full of variety, excitement. Deep ideas and at the same time extremely useful and relevant for understanding the materials and devices around us that constitute the backbone of our civilization Apart from being a varied playground for physicists to test strange quantum and statistical effects, this is the single most diverse and the largest discipline of physics, as reflected for example in the AIP PACS classification indexing. Further, In his talk, he conveyed his personal views on embarking upon teaching Physics of Materials to undergraduate as well as graduate students of Physics and Engineering. While it is a challenging task to venture into the intricate details of this vast arena, we focused on how to introduce some of the basic concepts of electronic structure in the manifestation of various properties of materials. To incite interest into the students by the teaching faculties, He shared some of the ‘happenings’ in this emerging discipline that includes Spintronics, and Graphene inspired 2D nanostructures, Topological materials etc. Dr. Saurabh wrapped up this Webinar by discussing how the advent of material informatics is expanding the horizon of the computational design of novel materials with tailored properties. The HOD Dr. Krishna Mohan addressed the welcome note and vote of thanks.

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Day 5: Thursday, 15 July 2020, 09.30 am to 11.00 am

Prof. Manjula Sharma
Professor of Science Education, OLT National Teaching Fellow
School of Physics, The University of Sydney, Australia

Title: Possible rationales for preparing teaching-learning techniques

Professor Manjula Sharma is a Professor of science education and heads the Physics Education Research (SUPER) group at THE UNIVERSITY OF SYDNEY, Australia. She is the Deputy Director of the Sydney Nano Institute. Professor Manjula Sharma completed her Ph.D. in physical optics in 1999 at The University of Sydney. Following her interest, she completed MEd research methods and stepped into physics education research. Professor Manjula Sharma, a leading science educator, has been involved in school curriculum matters for several decades. Her research is grounded in educational instrumentation and measurement in the areas of multimedia, inquiry-based approaches, and engaging teachers and students in investigative work.

In the talk, she covered the following. Teaching for student learning is a complex task. As scientists, can we approach teaching and learning scientifically? She spent her career searching for answers to this question. She reached an understanding which provides rationales, scientifically, for preparing one's own teaching to optimize student learning. The first element is identifying 'variables' which Schwab calls commonplaces, the teacher, the leaner, the subject matter, and the milieu, all held together by the curriculum. The second element is a deep dive into the variable, subject matter. She drew on the works of Vygotsky to frame: "What makes the subject, physics, hard for many learners?" Her third element is the variable, the learner. Here she considered the learner as an emotional human being, socially connected with others, adopting appropriate behaviors, and using their cognitive processes for learning. What emotional, social, behavioral, and cognitive processes does the learner use to access and learn the subject matter? How can the teacher select their teaching resources and techniques, so the learner engages, invests, and focuses on the subject matter? How does the teacher select and design their teaching for differing capabilities within their classes? The session was very informative, and the faculty members have interacted well with Prof. Manjula.
Dr. Rohit Dhir introduced the speaker and moderated the session. The HOD Dr. Krishna Mohan addressed the welcome note and vote of thanks.

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Day 6: Friday, 17 July 2020, 09.30 am to 11.00 am

Ms. PurbaChakraborty
Octava Technology & Services Pvt. Ltd. India

Title: Online teaching and learning methodologies

Ms. Purba is the Co-Founder of Octava Technology & Services, which is an organization based out of Kolkata, which provides Technology Enabled Learning, STEM tutoring, and Mentoring for young learners. The Organization also works on Skill Development Programmes. She is working on #4 SDG, supporting Quality Education, making it available to K12 learners. She aspires to help learners grow a mindset that helps them with computational thinking, which in the long run, helps then tackle concepts in STEM subjects. Further, it helps them solve problems and apply logical and cognitive skills and helps them ready for the Fourth Industrial Revolution. Purba is working with Cherie Blair Foundation supports Women Entrepreneurs round the world. She is spearheading a Pilot Project to introduce Coding, Data Analytics & Robotics in Schools in South Africa and coordinating with Japanese Collaborators to develop an Online Platform for reading and numeracy skills for Japanese Learners. She is a Public Speaker speaking on topics ranging from Technology, STEM careers, Marketing, Branding, Business Plans, International collaboration etc.

Ms. Purba's talk included the following,
1. Importance of online teaching and points to keep in mind as a teacher/facilitator
2. Difference between online and offline teaching
3. Various platforms and technologies available for online teaching
4. Massive open online courses
5. University as-a-platform for online teaching
6. Procedure for getting an online degree

She insisted that the university should have its own online courses platform so that it will be accessed globally.

Dr. Surya introduced the speaker and moderated the session. The HOD Dr. Krishna Mohan addressed the welcome note and vote of thanks.

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Day 7: Saturday, 18 July 2020, 09.30 am to 11.00 am

Prof. Shyam Diwakar
Director
Computational Neuroscience and Neurophysiology Laboratory,
Amrita Vishwa Vidyapeetham, India

Title: Complementing laboratory skills with online technologies: design and deployment of *Virtual Laboratories* for University-level higher education

Shyam Diwakar is the Lab Director of Computational Neuroscience and Neurophysiology Laboratory, a Faculty fellow at the Amrita Center for International Programs and an Associate Professor at the School of Biotechnology. He is the Institute Integration Coordinator and Co-investigator of Virtual Laboratories project, a major virtual labs initiative supported by Sakshat mission of MHRD, Government of India, and Principal Investigator of few other projects funded by Department of Science and Technology. He was awarded the Young Faculty Research Fellowship under the Sir Visvesvaraya Ph.D. scheme by the Department of Electronics and Information Technology, Govt. of India, in April 2016. He holds a Ph. D. in Computational Sciences from the University of Milan, Italy and had worked as a Post-doctoral Researcher at the Department of Physiology, University of Pavia, Italy, before joining Amrita.

Dr. Yuvaraj introduced the speaker and moderated the session. The HOD Dr. Krishna Mohan addressed the welcome note and vote of thanks.

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Day 7: Saturday, 18 July 2020, 15.00 to 16.30

Prof. Manoj K. Harbola
Department of Physics
IIT Kanpur, India

Title: Understanding energy bands in solids: their origin and how they determine the properties of solids

Prof. M. K. Harbola is a theoretical physicist whose chief interest lies in the Electronic Structure of Atoms, Molecules, and Solids using Density Functional Methods. He is involved in exploring fundamental aspects of density-functional theory, which is the most widely used theory of the electronic structure of materials. He has published around 130 papers in journals of high repute, including Physical Review Letters. He is also interested in exploring new and different ways of teaching physics at all levels and looks for ways of making the learning of physics exciting. He received a Distinguished Teacher Award in IIT Kanpur in 2007 for his excellent teaching.

Prof. Harbola started his talk with an interesting question, “How to motivate students for band structure?” and subsequently introduced the concept of DC conductivity and Hall coefficient. The experimental results of the temperature dependence of these quantities were shown. Subsequently, the different sign of the Hall coefficient and the origin of the energy gap was discussed in detail by the speaker. The talk provided a detailed explanation of what are the energy bands and how they arise as well as the significance of band in crystalline solids. An intuitive picture of the formation of the band by the collection of a large number of atoms and molecular orbit picture was presented. In a lucid manner, how the plane waves combine in a periodic potential to form energy bands was presented. Specifically, it was described in a beautiful way that the possible band overlap in 2-dimension and 3-dimension case can lead to the observation of different material properties in comparison to that predicted by 1-dimension band structure. The talk also described the dynamics of an electron in a band and how to interpret the results associated with it. In particular, the experimental results of an atom moving in the optical lattice was correlated with the motion of a particle in a band. This talk was extremely useful for faculty members teaching condensed matter physics to undergraduate and postgraduate students.

Dr. Saurabh Ghosh and Dr. Jaivardhan have introduced the speaker and moderated the session. The HOD Dr. Krishna Mohan addressed the welcome note and vote of thanks.