Report On Two Day "Hands-on-Training" on PCB-to-MMIC Design, Fabrication & Testing Lab-to-Fab Workshop (In Hybrid Mode)

A Two-Days Workshop on **"Hands-on-Training" on PCB-to-MMIC Design, Fabrication & Testing Lab-to-Fab (In Hybrid Mode)** was organized by University Science Instrumentation Centre (USIC) & Special Centre for Nanoscience (SCNS), Jawaharlal Nehru University (JNU), New Delhi-67 from 28th-29th April 2025 in association with IEEE AP-S/CRFID Chapter Delhi Section. The timings for Morning Sessions were 10.00 am to 1 pm and afternoon Session was 2.30 to 5.00 pm. The workshop was arranged for having or pursuing B.Tech/M.Tech/MS in (ECE & EEE) and/or BSc/MSc/PhD degree in physics/electronics. Nearly 25 candidates participated in the workshop. Inauguration for the workshop was held on CIS, Department of Biotechnology, JNU on 28th April, 2025 at 10:00am. The function was presided by Prof. Dipendra Nath Das Rector-II, Jawaharlal Nehru University and introduction of resource persons were given by Dr. Sandeep Kumar & Ms. Sunenya from SCNS. The resource persons from Delhi university, IIT Madras, IIT Delhi, IIT Hyderabad and VIA3D Software, Pune for their expert guidance and insightful presentations. Their patience and willingness to answer our questions were greatly appreciated. This workshop has been a fantastic opportunity to enhance our knowledge and skills in PCB design and fabrication. We are grateful for the hands-on experience and the knowledge we gained.

About Workshop:

In the line of Honourable Prime Minister's Skill Development Program for the Unnat Bharat Abhiyan which is inspired by the vision of transformational change in rural development processes by leveraging knowledge institutions, this training included fundamental concepts of MMIC/MIC PCB design, introduction to design schematic and layout using PCB design software. Hands-on training has given on source schematic, placing and routing the board and testing the fabrication data. Training session also includes demo on PCB fabrication using PCB making set-up. The training program will be useful for participants to develop their hardware circuits in project works. Participants will gain practical skills in activities such as circuit construction, exporting circuits to PCB layout, working with through holes and vias, and performing routing, among other techniques. This may facilitate to go for small scale industries set-up or to fulfil established companies represent skilled labours.

Objective of the Workshop:

The broad objective of this Workshop is to introduce PCB-to-MMIC designing and fabrication where participants will get exposure on the design concepts such as different Schematic designs, Component layout, Placement methods, and Routing Techniques. Moreover, the participants could provide a competitive edge over your fellow graduates when applying for a Job.

Resource Persons of the Workshop:

Resource Persons for the Workshop are from Dr. Mukesh Khandelwal, Delhi university, Dr. Ashwani Kumar, Delhi University, Dr. Manishankar Prasad Gupta, IIT Madras, Dr. Vikrant Kaim, CARE IIT Delhi, Dr. Pradeep Gorre, IIT Hyderabad and Dr. Yogesh, VIA3D Software, Pune. The details about the resource persons are given below.

Dr. Mukesh Khandelwal, Delhi university (Brief Profile, Title of Talk, Abstract, Date and Time)

Dr Mukesh Kumar Khandelwal is working as an Associate Professor in the Department of Electronic Science, University of Delhi South Campus. Dr Khandelwal completed his PhD from I.I.T. Dhanbad. He is an awardee of SERB S.I.R.E. Fellowship from Govt. of India to gain Post-Doctoral Research Experience at Loughborough University, United Kingdom. Dr Khandelwal is a senior member of IEEE and currently serving as joint secretary of the APS & CRFID chapter of the IEEE Delhi Section. He has published many SCI-indexed research papers, two patents, several book chapters and many international conference papers. Dr

Khandelwal is serving as a reviewer in many reputed international journals and transactions. Moreover, he has completed three research projects funded by Govt of India. His current research is focused on modern antennas and meta surfaces.

Title of the Talk: Antenna Design: PCB Methods, Masking and Fabrication

Abstract: Designing a PCB antenna involves several stages, from initial requirements to fabrication. Key considerations include frequency range, radiation pattern, and impedance matching. PCB methods utilize conductive traces etched on a dielectric substrate to form the antenna elements. Masking and fabrication involve creating the desired antenna geometry using processes like photolithography and chemical etching. The process of designing a PCB antenna includes analysing its intended use, selecting the appropriate type, designing its physical layout, optimizing impedance matching, fine-tuning the radiation pattern, fabricating the antenna, and conducting efficacy tests.

Date and Time: 28th April 2025 and 10:30AM

Dr. Ashwani Kumar, Delhi University (Brief Profile, Title of Talk, Abstract, Date and Time)

Dr. Ashwani Kumar received his M. Tech in Microwave Electronics and Ph.D. degrees in Electronics in 2006 and 2014, respectively from the Department of Electronic Science, University of Delhi, South Campus, New Delhi-110021, India. He was with the Department of Electrical and Computer Engineering, University of Central Florida, Orlando, Florida, U.S.A., for his post-doctoral research from 2016 to 2017. Currently, he is an Associate Professor in Department of Electronic Science, University of Delhi South Campus, New Delhi-110021, India. Earlier he was Assistant Professor in the School of Engineering, Jawaharlal Nehru University, New Delhi-110067, India and Department of Electronics, Sri Aurobindo College, University of Delhi, Delhi, India. His current research interests design and development of microwave passive components such as microstrip filters, dielectric resonator-based filters, MIMO antenna, UWB antenna and circularly polarized antennas using metamaterial. He is a senior Member of the IEEE MTT and AP-S Society. He is a secretary, IEEE CRFID-APS Joint Chapter Delhi Section. He has published 90 Journal and Conference Technical papers on Filters and Antennas and he has four Book Chapters. He has one Indian patent.

Title of the Talk: RF Filter: Design Techniques to Fabrication

Abstract: RF filter design and fabrication involves a range of techniques and processes, from selecting the appropriate filter type and topology to implementing the design on a PCB or using thin-film technologies. Key aspects include defining signal bandwidths, choosing the right PCB stackup, designing lumped or distributed filter elements, and finally, fabricating the filter using techniques like etching or sputtering. Marki Microwave uses a planar approach on GaAs substrates in the design of their RF filter solutions. Utilizing semiconductor fabrication techniques, they achieve narrow line widths and highly repeatable processing, resulting in small form factor passive devices for high frequency (mm wave) ultra-wideband solutions.

Date and Time: 28th April 2025 and 11:30AM

Dr. Manishankar Prasad Gupta, IIT Madras (Brief Profile, Title of Talk, Abstract, Date and Time)

He is working as a Lead Engineer cum Postdoc in indigenous InCent-LGD (India Centre for Lab Grown Diamond), IIT Madras Research Park where he is working on Solid State Power Amplifier under Solid-State Microwave Generator Group (SSMG). He received his Ph.D. in Electronics and Communication Engineering from National Institute of Technology Karnataka (NITK), Surathkal in 2024 and Master of Technology (Electronics and Communication Engineering) in 2013. He has a keen research interest in RF Integrated Circuit Design. His research interests include RF/mm-wave/sub-mm-wave GaN HEMT Integrated Circuits & Systems, RF Front-end Amplifiers. He has published 9 research publications in referred SCI journals and international conferences in IEEE publishers. He is the technical reviewer for various International SCI indexed journals of repute like IEEE Access and Circuits & Systems. He was awarded NTA-UGC-NET research fellowship & SERB Project fellowship for his PhD during 2021-2024. He also received Outstanding paper Award for the research work “High Efficiency Broadband Class F Power Amplifier for Sub-6-GHz 5G Application WAMS-2023, PDEU, Gandhinagar, Gujarat, and Cash award of 10,000 KRW for outstanding scientific research and excellent oral presentation entitled “Design and Performance Analysis of GaN HEMT Based Power Amplifier at L-5 & S-band Regime” at 1st International Nano-Technology and Nano-Systems workshop 2021, Republic of South Korea. He successfully completed SERB & ISRO projects as a JRF-SRF under the guidance of Dr. Sandeep Kumar who is the Associate Professor at SCNS, JNU Delhi. Dr. Manishankar has two filed South Korean Patent on his technology invention. Moreover, he has done tape out two-times Successfully on 65-nm

CMOS technology at Inje-University South Korea under the research collaboration of Indo-Korea DST inspired project.

Title of the Talk: RF Power Amplifier Process Flow: From Design to Layout

Abstract: The process flow for designing and laying out an RF power amplifier typically involves several key stages: specifying requirements, choosing a suitable transistor and operating class, designing the matching network, optimizing for efficiency and linearity, and then creating the physical layout.

Date and Time: 28th April 2025 and 2:30PM

Dr. Vikrant Kaim, CARE IIT Delhi (Brief Profile, Title of Talk, Abstract, Date and Time)

Vikrant Kaim (Member, IEEE) received the Ph.D. degree in electronics and communication from the Jawaharlal Nehru University, Delhi, India in 2022. He was a Postdoctoral Fellow with the Department of Electrical and Computer Engineering, University of Alberta, Edmonton, Canada, from Jan. – Dec. 2023. In Dec. 2023, he joined the Department of Electronics and Communication Engineering as an Assistant Professor at the Faculty of Technology, University of Delhi, Delhi, India. Since Dec. 2024, he has been working as an Assistant Professor at the Centre for Research in Electronics (CARE), Indian Institute of Technology Delhi (IIT Delhi). His research interests include applied electromagnetics with focus on bio-electromagnetics and biomedical devices for wearable, implantable and ingestible applications such as wireless power transfer, retinal prosthesis, cardiac implants, and capsule endoscopy. Mr. Kaim has been a recipient of the prestigious CSIR Senior Research Fellowship in 2019. He has authored /co-authored 26 publications in reputed international journals and conferences. He is also credited with 03 Indian patents. He is serving as a reviewer for the IEEE Transactions on Antennas and Propagation, IEEE Transactions on Microwave Theory and Techniques, and IEEE Transactions on Biomedical Engineering.

Title of the Talk: Implantable Medical devices: Design, Simulation, Measurements, and Challenges

Abstract: Biomedical telemetry permits the measurement of physiological signals at a distance, through either wired or wireless communication technologies. Physiological signals are obtained by means of appropriate transducers, post-processed, and eventually transmitted to exterior monitoring/control equipment. One of the latest developments of biomedical telemetry is in the field of implantable medical devices. Low-frequency inductive links have

long been the most prevalent method of biotelemetry for implantable medical devices. However, they suffer from low data rates (1−30 kbps), restricted range of communication (<10 cm), and increased sensitivity to inter-coil positioning. To overcome these limitations, research is currently oriented towards radiofrequency (RF)-linked implantable medical devices. A key and critical component of RF-linked implantable medical devices is the integrated implantable antenna, which enables bidirectional communication with the exterior monitoring/ control equipment. In a realistic scenario, implantable patch antennas will be mounted on the existing hardware of the implantable medical device, which will also serve as the ground plane. The design of implantable patch antennas has attracted high scientific interest for fulfilling the requirements of biocompatibility, miniaturization, patient safety and high-quality communication with exterior equipment. Numerical and experimental investigations are also highly intriguing. As technology continues to evolve, new implantable medical devices are being developed, and their use is expected to rapidly increase from an already large base.

Date and Time: 29th April 2025 and 10:00AM

Dr. Pradeep Gorre, IIT Hyderabad (Brief Profile, Title of Talk, Abstract, Date and Time)

He is working as a Project Staff in indigenous 5G Testbed Lab, IIT Hyderabad where he is working on India's 6G research and development and serving as an Assistant Professor in the department of Electronics and Communication Engineering, Vignan’s Foundation for Science, Technology and Research (VFSTR), Guntur. He received his Ph.D. in Electronics and Communication Engineering from National Institute of Technology Karnataka (NITK), Surathkal in 2023 and Master of Technology (VLSI Design & Embedded Systems) in 2010. He has a keen research interest in Analog/RF Integrated Circuit Design. His research interests include RF/mm-wave/sub-mm-wave CMOS Integrated and Circuits, Optical transceiver, RF Amplifiers and Implantable Circuits. He has published more than 30 research publications in referred SCI journals and international conferences and several book chapters in IEEE publishers; He is the technical reviewer for various International SCI indexed journals of repute like IEEE Access and Circuits Systems and Signal Processing. He was awarded MOE research fellowship for his PhD during 2018-2023. He also received Outstanding paper Award for the research work “High Efficiency Broadband Class F Power Amplifier for Sub-6-GHz 5G Application WAMS-2023, PDEU, Gandhinagar, Gujarat and Cash award of 50,000 KRW for outstanding scientific research and excellent oral presentation entitled “Design and Performance Analysis of TIA at THz/UWB Regime” at 1st International Nano-Technology and

Nano-Systems workshop 2021, Republic of South Korea. He successfully awarded one Ph.D. scholar as a co-supervisor and guiding two Ph.D. scholars as a supervisor in high-sensitive optical and RF front-end Amplifier designs. Dr. Pradeep has three filed South Korean Patent on his technology invention. Moreover, he has a centre of excellence Advanced RF, Microwave and Wireless Communications lab in VFSTR Guntur with research collaboration of Keysight Technologies Company, USA.

Title of the talk: PCB Design: Basics to Advanced and Hands on session on KCAD software

Abstract: A Printed Circuit Board (PCB) is a flat board made from a non-conductive material (often fiberglass) that is used to mechanically support and electrically connect electronic components using conductive pathways, tracks, or traces etched onto its surface. PCBs play a crucial role in modern electronics by providing a platform for assembling and interconnecting various electronic components in a structured and efficient manner. The global printed circuit board market size was USD 86.76 billion in 2023, accounted for USD 91.79 billion in 2024, and is expected to reach around USD 152.46 billion by 2033, expanding at a CAGR of 5.8% from 2024 to 2033.

Date and Time: 29th April 2025 and 12:15PM

Dr. Yogesh Solunke, VIAS3D (Brief Profile, Title of Talk, Abstract, Date and Time)

Yogesh Solunke

Solution Consultant | EMAG Technical Expert | RF Engineer

Yogesh Solunke is a highly skilled Solution Consultant and EMAG Technical Expert at VIAS3D. With over five years of experience in the RF engineering, he has cultivated deep expertise in RF design, antenna systems, and electromagnetic applications.

Professional Experience:

- **RF Design Engineer at MMRF Hyderabad**: Developed innovative RF solutions for cutting-edge communication systems.
- **Antenna Engineer, Ahmedabad**: Contributed to advanced antenna design and engineering for critical applications.

Academic Background:

- **(Ph.D.) in Communication Engineering**, VNIT Nagpur
- **M. Tech in Communication Engineering**, IIITD&M Kanchipuram
- **B. Tech**, MIT Aurangabad

Yogesh is passionate about leveraging his technical knowledge to drive innovation in RF systems and electromagnetic solutions. He is a committed professional with a proven track record of delivering impactful results in research and development.

Title of the talk: CST Studio Software Design and Simulation

Abstract: CST Studio Suite® is a high-performance 3D EM analysis software package for designing, analysing and optimizing electromagnetic (EM) components and systems. Electromagnetic field solvers for applications across the EM spectrum are contained within a single user interface in CST Studio Suite. The solvers can be coupled to perform hybrid simulations, giving engineers the flexibility to analyse whole systems made up of multiple components in an efficient and straightforward way. Co-design with other SIMULIA products allows EM simulation to be integrated into the design flow and drives the development process from the earliest stages. Common subjects of EM analysis include the performance and efficiency of antennas and filters, electromagnetic compatibility and interference (EMC/EMI), exposure of the human body to EM fields, electro-mechanical effects in motors and generators, and thermal effects in high-power devices.

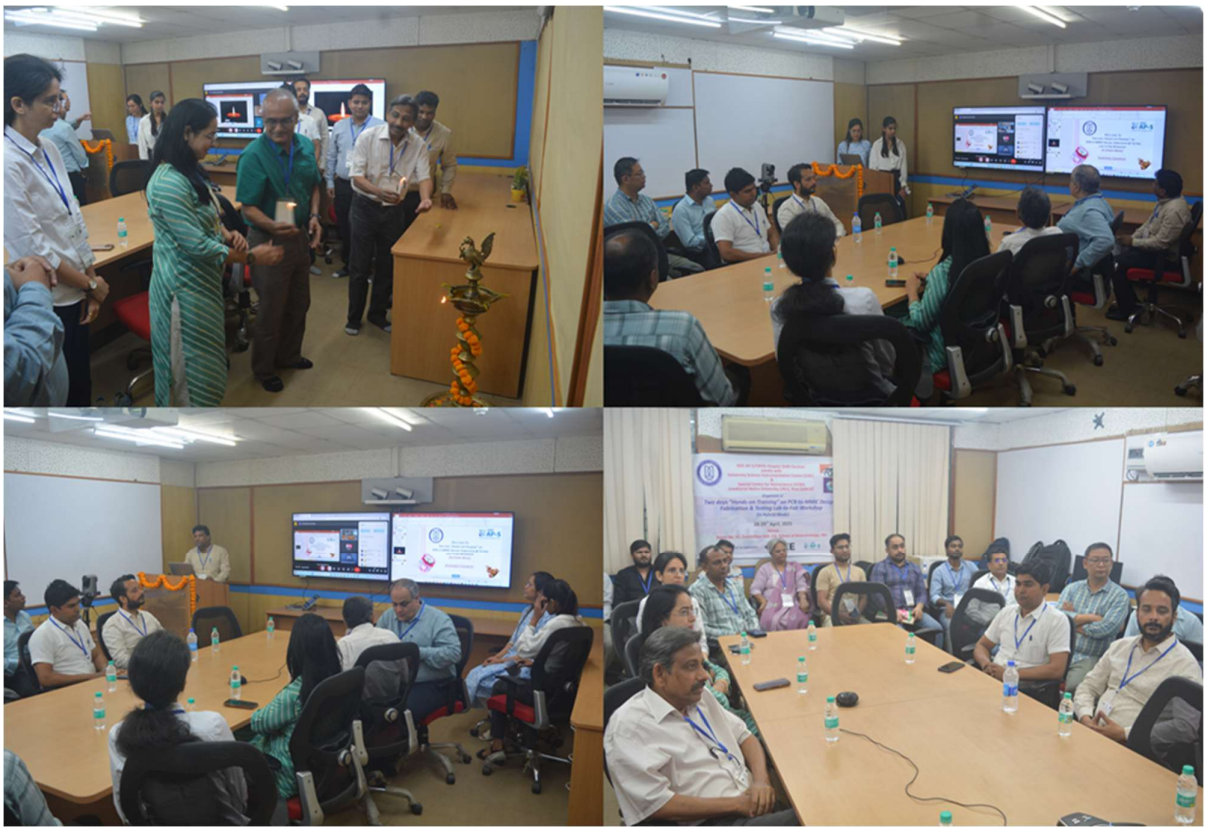
Date and Time: 29th April 2025 and 12:45PM

Moreover, Mr. Pusphendra and Ms. Sheetal, PhD students under the supervision of Prof. Bijoy Kumar Kuanr were delivered a Hands-on Training on PCB Prototyping with Process flow, mask design and photolithography and Hands-on Training on Major Measurement equipment's such as network analyser, spectrum analyser etc.

First day 28.04.25

The First day 28.04.25 workshop Inaugural function was held on CIS, DBT, JNU at 10:00am. The inaugural function was started with light lamp and welcome address. The highlights of SCNS and USIC are given by Prof Bijoy and Mr. Sanjeev Kumar, Director, USIC. Then, the chief guest has delivered some remarkable address and in continuation, the guest of honour was given his speech on workshop theme and the presidential address was given by Rector-II, JNU and finally we concluded inauguration ceremony with vote of thanks. In the first day, the resource persons gave introduction about the discrete components with working principal and its applications in circuits. Fundamentals of circuit rig up. Testing and troubleshooting the circuits. Introduction to ADS and HFSS tool with designed example.

Screen Shots for First day 28.04.25

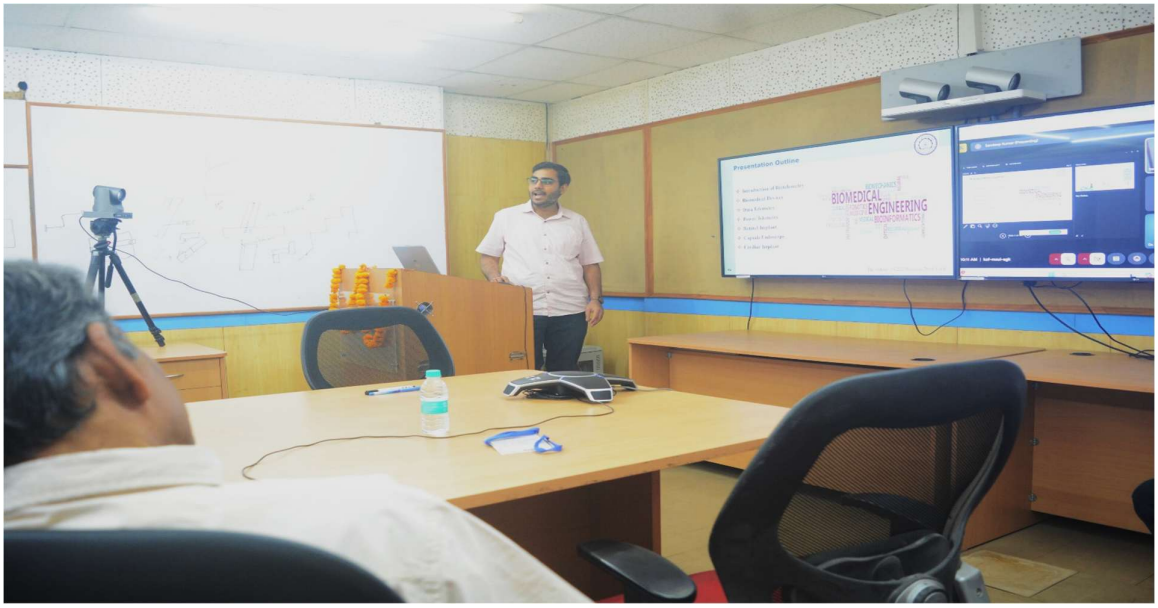


Second day 29.04.2025

The Second day 29.04.25 Forenoon and Afternoon sessions resource person delivered lecture on how to do schematic design using HFSS, KCAD and CST Studio PCB tool for different

application circuit. Own library creation, components creation. PCB layout design for single sided PCB board fabrication. Gerber file generation from PCB tool fabrication. Afternoon, participants got the Hands-on-training exposure on Masking, Etching, photolithography, DC & RF Sputtering, Thin film generation, design a novel product and measurements such as VNA testing etc.

Screen Shots for second day 29.04.25



The Workshop was concluded at 05.00pm. The workshop ended with the vote of thanks by Dr. Sandeep Kumar, Associate Professor, SCNS, JNU. Management sponsored for Lunch to resource persons for all two days and Hi-tea to faculties, participants and students of SCNS for all the 2 days. Feedback forms were collected from participants at the last day. The workshop was highly informative to all candidates. Thus, workshop provided valuable awareness and insights on the various aspects of design and fabrication of PCB.

Outcome from the Workshop:

- Concept to design and product development skill.
- Hands-on Training on PCB Prototyping.
- Hands-on Training on Major Measurement equipment's such as network analyser, spectrum analyser etc.
- Understanding of PCB fabrication process.

Participants List: Workshop

Name of the Candidate	Category of the candidate: either as student/research scholar/faculty/industry	Organization Name and Department Name
Aryan Tyagi	Student	Jawaharlal Nehru University
Anand Kumar	Student	DSEU New Delhi (Electronics and communication engineering)
SHAGUN MALHOTRA	Student	Delhi Skill & Entrepreneurship University
Dr. Manorama Patri	Faculty	Central University Himachal Pradesh, Dharamsala
Utkarsh Gupta	Student	Special Centre For Nanoscience
Deepak Vats		VIPS-TC
SHANTHIP AJEY V	Student	Amity University Rajasthan, B.tech (ECE)
Manishankar Prasad Gupta	Research Scholar	InCent-LGD, IIT Madras
PANTHAGANI SANDHYA RANI	Research scholar	Vignan university
T.Bhargav Sai Srinivas	Student	Vignan's Foundation for Science, Technology & Research (Deemed to be University) and ECE
B.SAMPATH KUMAR	STUDENT	ECE
Shivanand Kulakarni	Research Scholar	National Institute of Technology Karnataka (NITK) Surathkal, Department of Electronics and Communication Engineering
Miryala Sharath Chandra	Student	ECE, VFSTR (Deemed to be University)
Dr. Venkata A P Chavali	Faculty	IIIT SURAT
PABITRA MAITY	Student	The University of Burdwan, Department of Physics
KRISHNA ABHISHEK	Student (M.Tech)	Jawaharlal Nehru University &

		SPECIAL CENTER FOR NANOSCIENCE
R Akhil karthik	Industry	Altair Engineering Pvt Ltd
SK.Aadam Shafi	Student	Vignan's Foundation for Science, Technology & Research (Deemed to be University)
Vijay Kumar	Industry	Taoglas Pvt Ltd
Om Prakash Nirala	Research Scholar	Dr B R Ambedkar National Institute of Technology and ECE Department
BEERAKA SAI HARSHA VARDHAN	Student	VIGNAN UNIVERSITY FOR FOUNDATION, SCIENCE AND RESEARCH and ECE
B Venkata Naga Karthik Reddy	Student	Vignan's foundation of science and technology research (ECE)
Anuj Kumar	Obc	Scns
Rinku Nayak	Student	Special Centre for Nanoscience
Prateek Srivastava	Student	Special centre for Nanoscience, JNU