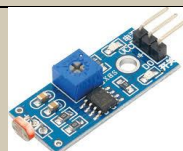


5-day FDP on Sensors Technology

3-7 November 2020



REPORT



5 Day Faculty Development Program (FDP) **SENSORS TECHNOLOGY**

AICTE Training and Learning (ATAL) Academy

A program approved under
संयोजिका (Chronicle) of Accelerate Vigyan (AV), SERB, Govt of India

Organised by:
Department of Physics
The University of Burdwan
Burdwan 713 104
West Bengal

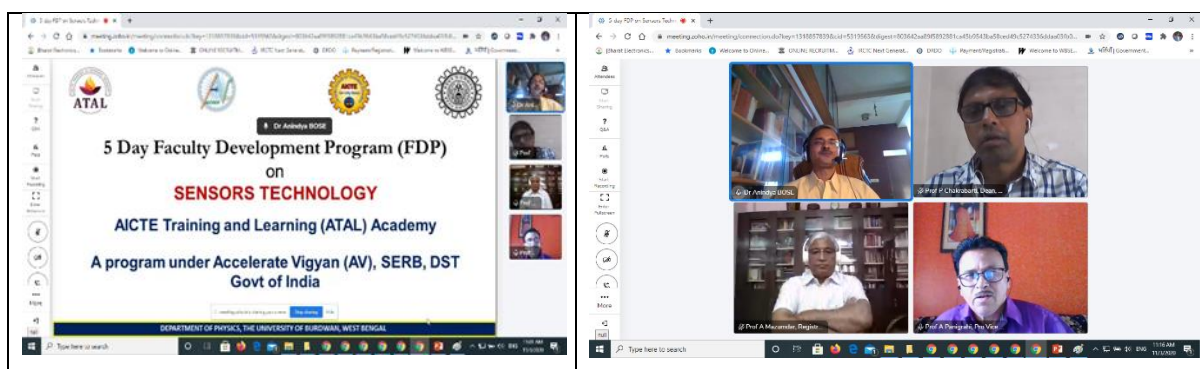
Date:
03-07 November, 2020
Contact: abose@phys.buruniv.ac.in

5-day FDP on Sensors Technology
Organized by The University of Burdwan, West Bengal
3-7 November 2020

5-day Faculty Development program (FDP) on Sensors Technology was organized by The Department of Physics, The University of Burdwan, West Bengal during 3-7 November, 2020. The program was sponsored by AICTE Training and Learning (ATAL) Academy and the program is also approved under संयोजिका (Chronicle) of Accelerate Vigyan (AV), SERB, Govt of India.

The program is conducted completely online using ZOHOO Meet platform. Total 110 participants from different parts of India successfully completed the course fulfilling the attendance and marks requirements stipulated by ATAL Academy. 16 experts from educational institutions, research organization, and Industry delivered lectures and hands on training in the program, out of which 13 experts were from India and 3 experts from other countries. There were 14 technical sessions, 2 sessions on value and ethics, 2 inauguration and valedictory sessions. 1 optional networking session for the participants and 1 optional online cultural program were also organized. On the final day online evaluation of 1-hour duration was also organized. Dr Anindya Bose of Department of Physics was the coordinator of the FDP.

The program was inaugurated by Professor Ashis Kumar Panigrahi, Hon'ble Pro-Vice Chancellor, The University of Burdwan. Other dignitaries present were Professor P K Chakravarti, Department of Physics, Dean, Faculty of Science and Prof A Mazumdar, Registrar (Officiating), The University of Burdwan. Dr Anindya Bose, Coordinator welcomed the participants and Prof P Mitra, Head, Department of Physics proposed the vote of thanks. Screenshots of the Inaugural Program is shown below.



The complete program schedule is shown in Page 2.



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Program Schedule
(03- 07 November 2020)



Date/ Day	10:30-12:00	12:15-13:45	13:45-14:30	14:30-16:00	16:10-17:10	17:10-17:40
03/11/2020 (Tuesday)	Inauguration and Introduction	Dr M Sree Ramana Navigation sensor technologies	B R E A K	Prof Dinesh Manandhar GNSS Receivers and Locations Sensors in Android Devices	Swami Divyananda Value and Ethics	-
04/11/2020 (Wednesday)	Prof P K Chakrabarti Different aspects of Sensors in Materials Science from Bulk to Nano	Dr Surajit Kundu Frequency Selective Surfaces in Remote Sensing and Sub-surface scanning Applications		Dr Abhishek Kumar Jha Electromagnetic Sensing: Waveguide Techniques	Participants' Networking (Optional)	
05/11/2020 (Thursday)	Prof M J Akhtar Metamaterial Inspired High Sensitivity Planar RF Sensors and Their Applications	Dr Shweta N Shah Wireless Body Sensor Network		Mr Omar Valdés Low-power GNSS positioning for IoT solutions	Dr Debabrata Biswas Integrating salient sensors in Raspberry Pi and working with them	
06/11/2020 (Friday)	Prof R Ghatak Electromagnetic Sensors	Mr Hemanth Kumar H D Sensors & Internet of Things		Swami Suparnananda Value Education, Ethics, Yoga and Meditation	19:00 – 20:00 pm	
07/11/2020 (Saturday)	Prof M K Mondal Frequency Modulated Continuous Wave (FMCW) Radars and its applications as industrial and biomedical sensor	Mr Parna Ghosh Use of Sensors and IoT Technology in automotive in this Digital Era		Mr Varadarajan Krish Smart Metering the key efficient energy management in Smart Cities	Virtual Cultural Program (Optional)	
					16:10-17:10	17:10-17:40
	Test and Evaluation	Valediction				

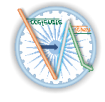
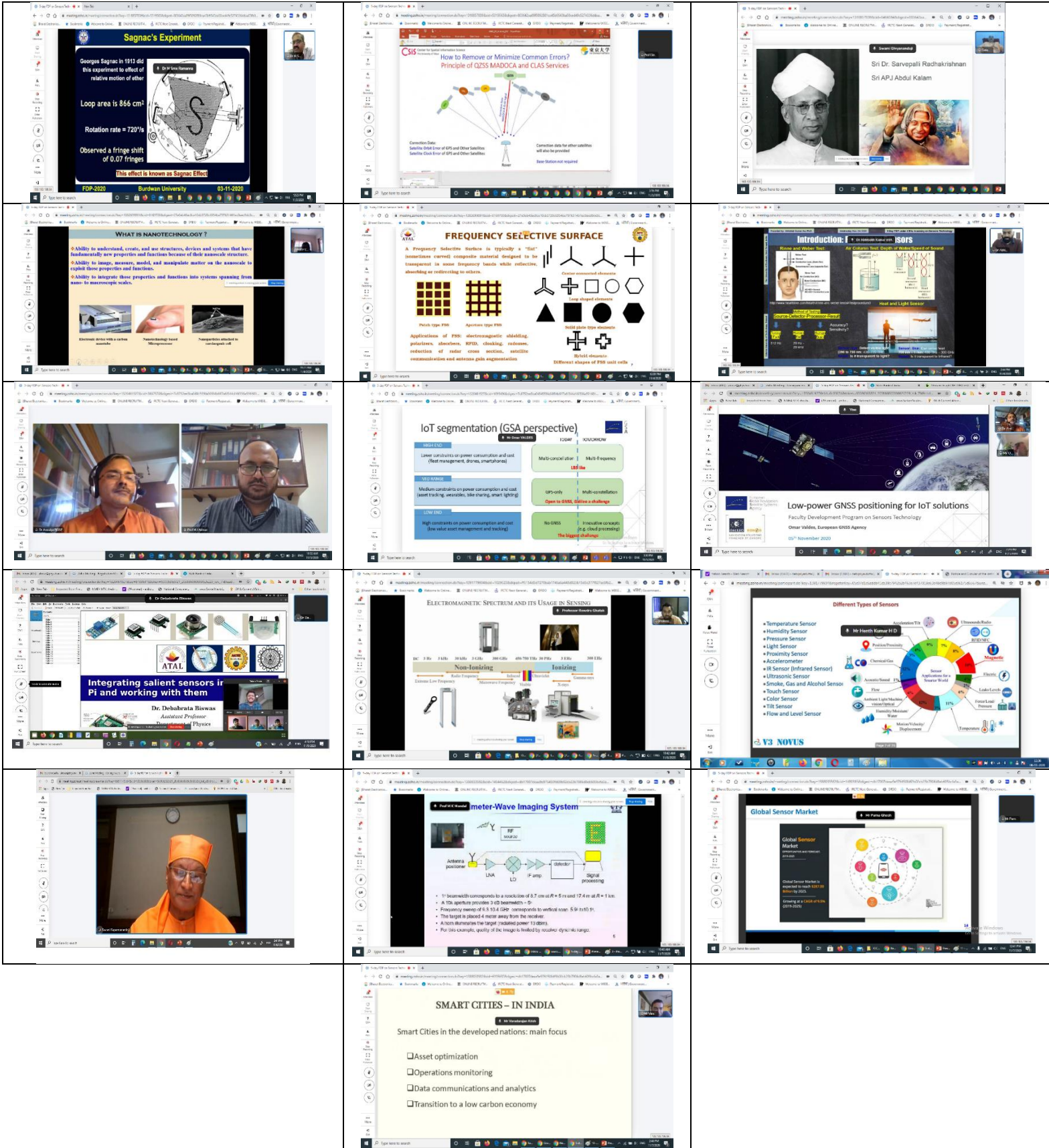


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Sample screenshots during the event are shown below



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Speakers, Brief Bio and Abstract



Dr M Sree Ramanna, Scientist F, RCI, Hyderabad, DRDO

M. Sc Physics (Modern optics & Laser Physics), Ph. D in Physics
2002-04: Assistant Professor, Vasavi College of Engineering
2004-05: Contract Engineer, Electro Optical Instruments Research Academy
2005-Till date: Scientist, Research Centre Imarat (RCI), DRDO, Hyderabad
Teaching: R&D of Sensors and Metrology, Modelling and Simulation
Guided more than 75 B. Tech/M. Tech/M. Sc Tech students in the past 10 years, Publications in major journals.
Patent (Indian): Radio Frequency Analyzer and a Method for Determining an Optimum Resonant Frequency of Operation for Ring Laser Resonators

Talk Title: Navigation Sensor Technologies

Abstract: Navigation sensors are required to find out the position of vehicles/ platforms moving from one place to the other. They play a major role in satellite and missile launch, ships and submarines etc. Inertial sensors are most used sensors for navigation. The current state of the art inertial sensors are not capable of dead reckoning as they need to GPS/GNSS update to achieve the required specifications/accuracy. Since GPS/ GNSS updates would not be available under water, in large buildings and during wartime, it is essential to develop new sensors capable of dead reckoning. In this presentation existing state of the art inertial sensors will be discussed and also possible future sensors technologies will be presented.



Prof Dinesh Manandhar, Associate Professor (Project) at The University of Tokyo, Japan.

Bachelor's in electrical engineering from Punjab Engineering College, Chandigarh, India, Masters from Asian Institute of Technology (AIT), Thailand and Ph. D. from The University of Tokyo, Japan
His research works include indoor navigation, GNSS signal analysis and design, jamming, interference and spoofing (JIS) detection and mitigation.
He is currently working on GNSS signal authentication based on QZSS signals. He has also developed IMES (Indoor Messaging System) based on GPS for indoor navigation.

Title: GNSS Receivers and Location Sensors in Android Devices

Abstract: Location information is so important that without this no services can be effectively and efficiently provided. For example, if you call an emergency number from a mobile phone for rescue, your correct location information shall be available for quick rescue. The problem is to provide location information within an accuracy of about 10 – 30 meters whether the caller is outside or inside a building. Many countries have regulations to provide location information within certain level of accuracies by using



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available sensors in a smart phone. Today, smart-phones and tablets have many types of sensors including GNSS receivers. These devices are used to estimate the best possible location data.

In the current situation of Corona pandemic, location and mobility related data are extremely important for contact tracing, control and management. It is not possible to handle the current situation without proper location data and spatial analysis.

In this program, we will discuss about GNSS receivers in android devices. Recently, GNSS receivers in android devices have become so powerful that these data can be used to output high-accuracy position of 1- 3 meters. Technologies are available even to provide sub-meter accuracy by doing special signal processing like RTK. It's not only the GNSS receivers inside Android device but also Google APIs related with location engine and other sensors. New APIs related with location engine are now available to extract GNSS raw data like carrier phase data (for RTK), navigation data bits, AGC values and so on. All these new APIs and hardware (GNSS receivers) related with location will generate many new applications for completely new area of business opportunities which otherwise would not have been possible.

Besides, of all these new capabilities in smart phones, there are still many problems related with position computation when a user is indoors or when a correct floor or room level accuracy is needed. We will discuss some of these problems, possible solutions, location accuracies and signal processing methodologies as well.



Swami Divyananda, Secretary, Ramkrishna Mission Saradapitha

Studied MSc Physics in Calcutta University during 1972-1974.

Joined Ramakrishna Mission Vidyamandira Physics Department in 1978 as honorary lecturer and officiated as Vice-Principal from 1978 – 1984.

Joined Ramakrishna Mission Vivekananda Centenary College and worked as Vice-Principal & Principal acting during the period from 1984-1999.

Taught Physics in honours as well as pass level and HS(+2) for this 21 years.

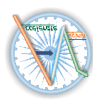
He Was posted at Ramakrishna Mission Tripura (Agartala), Malda and Saradapitha. He serves the downtrodden people of West Bengal and Northeast, worked for the welfare of Prisoners of the Correctional Home of West Bengal from 2003 till date.

Talk Title: Value and Ethics

Abstract: Value stands for customs, traditions, ideals and belief systems of either an individual or group. It also stands for the lifestyle of individuals and families. Therefore, different people classify these values according to their styles of logical discussions.

A society is rich when most of the people are of higher values. Positive or constructive thought, unselfishness, truthfulness are the basic values of a human being. Teachers, doctors, lawyers, politicians, students, parents, management staff all professionals are required to have certain values. Values denote the priority of the element of our behavior which we value the most.

For the survival of a Nation, values of the citizens are the most important factor. Values may be called the pillars of the structure of any institution. The nearest synonym for value system is Character. Character is again integration of all good habits which makes individual as well as the mass enlightened. Only external knowledge is not enough. In addition to material knowledge we must give stress on our value system or



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character. Character-making or Man-making education is needed and then only we can build a nation. National growth, economic development, everything depends on our values and for that character and habits are to be improved. In our lives, everybody was benefitted by the values and characters of our teachers. We are very grateful to our teachers because in addition to teaching material subjects, they taught us the fundamental elements of character. They were roles models before us. They had self-control, unselfishness, love and sympathy for us. Self-respect, self-confidence, self-reliance, patriotism, courage are all good values they taught us.

Ethics are a combination of “Do & Don’ts” or moral values only. The Taittiriya Upanishad gives a list of such instructions to students: Speak the truth. Practice dharma. Do not neglect your studies as long as you live. Pay for whatever you learn. Get married and have a couple of kids. Do not swerve from the truth. Do not swerve from dharma. Do not neglect personal welfare. Do not neglect prosperity. Do not neglect your studies and teaching what you know. You have duties to society; do not neglect your duties. Treat your mother as God. Treat your father as God. Treat your teacher as God. Treat your guest as God. Whatever deeds are faultless, these are to be performed—not others. Whatever good works have been performed by us, those should be performed by you—not others. Wherever you find persons who are superior to you—you should respect them. Learn to give back to society. And give what you wish to give with respect, not without faith. Give according to your capacity, with modesty, with fear, with sympathy. Now, if there arises in your mind any doubt concerning any act, or any doubt concerning conduct, you should conduct yourself in such matters as superior persons around you would conduct themselves. This is the rule. This is the teaching. This you should observe. This alone should be observed.



Prof P K Chakrabarti, Professor of Physics and Dean, Faculty of Science, The University of Burdwan

Ph D from the University of Burdwan and worked as Post Doctoral Fellow in Germany and France.

Professor, Department of Physics, The University of Burdwan,
Invited Professors in France in the year 2002 and 2016.

Fellow, West Bengal Academy of Science and Technology,

Total Publication in International Journals: 92

Ph D awarded under his supervision: 14

Number of Projects handled: 07 (Total Cost: ~1.75 Crore)

Talk Title: Different aspects of Sensors in Materials Science from Bulk to Nano

Abstract: Investigations of materials in the bulk and nano regime have been the subject of current interest for their diverse activities. Most of the properties of any material have been changed in the nano-regime. This departure of different properties enhances the potentiality of applications of nanosystems compared to those of their bulk counterparts. Due to this fact nanoscience and nanotechnology has entered very quickly in different areas of applications including sensor technology. Though there is no restriction in the dimension of designing a bulk sensor, but in the nanosensing devices there must be a limit of ~100 nm in at least one direction. To investigate the details of sensors it is necessary to know different aspects like principle, concerned properties, stability, durability, etc. Actually, the sensor is used to sense or detects a



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variable quantity with some functionalities and this is usually occurred electronically, and converts the measurement into the desired signals. Nanosensors are applied for monitoring physical and chemical phenomena in the nano regime. Different properties like magnetic, electric, thermal, dielectric, ferroelectric, multiferroic etc. of materials either in bulk or nano regime are normally exploited to design and fabricate a sensor. The present talk will try to cover all these aspects.



Dr Surajit Kundu, Assistant Professor, National Institute of Technology Sikkim

Studied B. Tech in E&CE from Academy of Technology (2009), M. Tech from IIT, Kharagpur (2012) and Ph. D. degree from NIT Sikkim (2018).

He has served as Asst. Professor in Supreme Knowledge Foundation Group of Institutions (2012), in UIT, The University of Burdwan (2013) and since 2014, in the Department of ECE, NIT Sikkim.

Senior Member, IEEE and URSI. Published 35 research papers. He is a regular reviewer of reputed journals- IET Microwaves, Antennas & Propagation, IET Electronics Letter, IEEE Antennas and Wireless Propagation Letter, AEÜ - International Journal of Electronics and Communications, International Journal of RF and Microwave Computer-Aided Engineering, Radio engineering

His research interest includes antenna design, ultra-wideband communication, frequency selective surfaces, satellite communication, navigation and ground penetrating radar. He received “Young Indian Radio Scientist” award from URSI-InRaSS in AP-RASC 2019.

Talk Title: Frequency Selective Surfaces in Remote Sensing and Sub-Surface scanning Applications

Abstract: Remote sensing is the acquiring of information related to the physical properties of an area from a distance. Frequency selective surface (FSS) that is periodic array of symmetric unit cells can be thought as wireless counterpart of conventional filters for frequency sensing and selection of desired band. In atmospheric remote sensing, miniature FSS is used in the quasi-optical feed network to diplex the polarized and ultra-low power EM radiation. Design methodology and performance analysis of such FSSs which operate in millimeter and terahertz waves and used for remote sensing are discussed. Another important aspect of FSS can be identified in ground scanning applications where ultra-wideband (UWB) FSS is integrated to the UWB antenna unit for radiation improvement in the broadside direction. Design methodology and characteristic analysis of high gain UWB ‘antenna-FSS’ composite structures are discussed and its applicability in ground penetrating radar (GPR) is established. High lateral resolution with sufficient surface penetration facility is realized using the compact FSS.

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Dr Abhisekh Kumar Jha, Assistant Professor, Gdansk University of Technology, Poland

He is B.E. (in E.C.E. with honors, 2009) and M.Tech. (in Microwaves with distinction, 2011) from the University of Burdwan, Ph.D. degree with a major in R.F. and microwaves from the I.I.T. Kanpur, 2017. He was associated with the Institute of Photonics and Electronics, Prague, as the Post-Doctoral Research Fellow. Since 2018, he is working as the Assistant Professor in the Department of Microwave and Antenna Engineering at the Gdansk University of Technology, Poland.

He Authored/co-authored more than 50 articles in reputed journals. He holds one patent on metamaterial-based planar microwave sensors His technical articles have been cited more than 500 times, with h-index 12. His current research interests include the analysis and design of novel microwave circuits and components, development of R.F. and microwave sensors for nondestructive testing, and measurements of intrinsic and physical properties. He is currently serving as the Associate Editor for two leading IEEE journals- IEEE Access and IEEE Sensors Journal, and a potential reviewer of the IEEE Transactions on Industrial Electronics, the IEEE Transactions on Microwave Theory and Techniques, IEEE Transactions on Instrumentation and Measurement, and Nature Scientific Reports.

Dr. Jha received several awards- Microwave Graduate Fellowship Award 2015, IEEE SIGHT DESIGN awards in 2015, University Gold Medals for B.E. and M.Tech. Degrees, the Gandhian Young Technological Innovation Award 2016. He is the recipient of several international travel grants, including the young scientist travel grant from the Department of Science and Technology, India, in 2016. He was awarded IDUB Premium Award from the Rector of the Gdansk University of Technology in 2020.

Talk Title: Electromagnetic Sensing: Waveguide Techniques

Abstract: The talk will start with an introduction to electromagnetic sensors and showcase the recent works at my group. It will discuss the problems in electromagnetic sensing of materials and their solutions with various advanced transmission lines and waveguide techniques. The talk will further elaborate on the idea of resonant sensing using the metallic waveguide and substrate integrated waveguide. The role of innovative metamaterial waveguide, such as an epsilon-near-zero waveguide, would be discussed for the dielectric sensing.



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Prof M J Akhtar, Professor, Indian Institute of Technology Kanpur



He was a Scientist with the Central Electronics Engineering Research Institute, Pilani, India, from 1994 to 1997, where he was involved in the design and development of high power microwave tubes. From 2003 to 2009, he was a Post-Doctoral Research Scientist and a Project Leader with the Institute for Pulsed Power and Microwave Technology, Karlsruhe Institute of Technology, Karlsruhe, Germany, where he was involved in a number of projects in the field of microwave material processing. In 2009, he joined the Department of Electrical Engineering, IIT Kanpur, Kanpur, India.

He has authored two books, two book chapters, and has authored or co-authored over 300 papers in various peer-reviewed international journals and conference proceedings. He holds two patents on RF sensors for testing of solid and liquid sample, and one patent on nanomaterial integrated RF sensor for detection of harmful gases in the environment. His current research interests include RF, microwave and THz imaging, microwave nondestructive testing, metamaterial inspired RF sensors, SIW based RF devices and sensors, RF energy harvesting, plasmonic devices, functional materials, wideband electromagnetic absorbers, UWB antennas for imaging, and design of RF filters and components using the electromagnetic inverse scattering.

Dr. Akhtar is a senior member of IEEE, fellow of the Institution of Electronics and Telecommunication Engineers, New Delhi, India, and a Life Member of the Indian Physics Association and the Indo-French Technical Association. He is a recipient of the CST University Publication Award in 2009 from the CST AG, Darmstadt, Germany. He served as a Chair of the IEEE Microwave Theory and Techniques Society Uttar Pradesh Chapter from 2013 to 2015, and the Vice-Chair of the IEEE Uttar Pradesh Section in 2015.

Talk Title: Metamaterial Inspired High Sensitivity Planar RF Sensors and Their Applications

Abstract: The planar technology, which is widely being used for developing various types of modern RF devices and components, can quite effectively be used to develop RF sensors. In recent years, the concept of metamaterial inspired planar RF sensor has gained lot of popularity due to its high sensitivity as compared to the conventional sensors. The high sensitivity in these types of sensors is basically obtained due to enhancement of the electromagnetic field in certain region so that the interaction of test material with the EM field is maximized. The high sensitivity of these types of sensors is advantageous in certain situations such as monitoring of quality of various edible products, and to detect small level of contamination in high grade materials. This talk will provide a general overview of metamaterial inspired planar RF sensors and their applications.



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Dr Sweta N Shah, Assistant Professor, Sardar Vallabhbhai National Institute of Technology Surat



Dr Shah is BE in Electronics and Communication Engineering in 2004, M.Tech. in Communication Systems in 2008, and PhD in Wireless Communication in 2015.

She is handling various administrative and academic responsibilities. She has guided 50+ UG projects on multiple objectives, 10+PG dissertation, and 3 PhD scholars. She is currently mentoring 5 PhD Scholars, 2 PG dissertations, and 3 UG projects. She has worked on two funded projects from ISRO and Dr. Shah's contribution is appreciated in the research community working for Indian navigation satellite systems (IRNSS/NavIC).

Above that, she has mentored 4 TEQIP based projects as well. Dr. Shah has 28 reputed international journal publications and 15 international conference publications. A patent is also registered on her name. She has organized 18 programs for faculties, researchers, and students in wireless communication, IoT, GNSS, etc. She has delivered 23 experts' talks on various topics as per the demand of research. Dr. Shah is a member of many professional societies, like IEEE, IETE, ISTE, ACM, ION.

Talk Title: Wireless Body Sensor Network

Abstract: Creating a wireless body sensor network is quite complex, challenging, but exciting compared to creating a wireless communication network. Collecting accurate data from the living body, predicting them correctly, analyzing it efficiently, and concluding it is as good as making a communication link between human organs and sense via the brain. Getting insight information from the body and measuring it externally is always most popular among scientists. Up to a certain extent, we have achieved that also. Such devices are becoming an indispensable component of our daily life. The most famous example is the Fitbit. There are 29.57 million users of a Fitbit till 2019. This number clarifies that body sensors are becoming more and more effective in making people rely on their daily lifestyle. The wireless body sensor network is all about knowing the engineering science, architecture, types of sensors, and, most notably, their applications. The talk will focus on various case studies to understand the WBSN more interestingly.



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Mr Omar Valdes, Market Development Officer, European GNSS Agency Prague

Mr. Omar Valdés holds a master degree from the University of Applied Sciences in Offenburg, Germany and a Master in Sciences of Management from the Catholic University of Louvain, Belgium. Mr Valdés joined the European GNSS Agency (GSA) in 2013, where he is currently a Market Development Officer responsible for fostering the adoption of the European GNSS in the Space and IoT market segments. His previous experience included managing service development projects for the Directorate General for Informatics of the European Commission and the SSA and ARTES programmes of ESA.

Talk Title: Low-power GNSS positioning for IoT solutions

Abstract: Global Navigation Satellite Systems (GNSS) have become key enablers of positioning for different applications. From airplanes landing in the most isolated runways to the mobile phone that pretty much everyone has in their pockets, GNSS has become the technology of choice for knowing where we are and tell us where we are headed to. Yet, in applications where power consumption is critical, GNSS has faced some challenges to be widely adopted, mainly, due to a reputation of being a high-power consuming technology. In this lecture new advances in the use of this technology will be presented that make it quite appealing for IoT and other power-critical applications



Dr Debabrata Biswas, Assistant Professor, Bankura University, West Bengal

He is B.Sc. in Physics Hons from Rampurhat College, affiliated to Burdwan University. Masters in Physics with Radiophysics and Electronics as special paper from Burdwan University. Dr Biswas is serving the Bankura University since 2019. Previously he hold the same post at Rampurhat College since 2017.

His interests are in nonlinear dynamics and complex systems and his Ph.D. thesis dig out the design and synchronization of chaos and hyperchaos in time-delayed electronic systems. Present he is working in the field of coupled networks and multistable systems. Dr. Biswas has travelled Max Planck Institute for Physics and Complex Systems, Dresden, Germany in 2016 and 2018.

He has published 17 research papers in international journals of high repute, like Physical Review E, Nonlinear Dynamics, Chaos, IJBC, etc. He has published a full book from Springer-Nature on time-delayed systems and their synchronization problems. Dr. Biswas has



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	profound interest in electronic control systems, sensors and software designing.
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Talk Title: Integrating salient sensors in Raspberry pi and working with them

Abstract: At present days electronics has come to its full potent. In this regard the use of computer is obvious. The present technology has reduced the shape of a computer to fit in a pocket. One such great computer is Raspberry pi. In the lecture we shall discuss and provide a hands-on over the integration of different sensors to Raspberry pi. The process of sensing and control these will be discussed elaborate with demo will be provided in the talk.



Prof R Ghatak, Professor, National Institute of Technology Durgapur

Dr Ghatak received his M Sc, M Tech degrees from The University of Burdwan and Ph D from Jadavpur University. He started as a Asst Professor at NIST, Odisha and he joined Department of Physics, The University of Burdwan. Currently he is working as Professor in Deptt of ECE, National Institute of Technology, Durgapur, West Bengal. Professor Ghatak is an eminent researcher with large number of publications in reputer international journals.

Talk Title: Electromagnetic Sensors

Abstract: Perhaps we miss the fact that an em sensor is an antenna. Hence, its efficacy in sensing will depend on efficient design of the antenna as well as its sensitivity to the measurands. The tutorial covers both the aspects of sensing, namely, detection and measurement. We should also keep in mind that in some applications, antenna plays the dual role of sensing and also in communicating the information that is sensed. The tutorial would delve into the fundamental concepts that young researchers tend to digress from during design and characterizing stages. Therefore, a clear understanding of the core facts would nudge EM sensor designers to efficiently solve design requirements.



Mr Hemanth H D, Director - Business Development, V3Novus Pvt. Ltd.

B.E Telecommunication SSIT Tumkur (2014),
 Director - Business Development, V3Novus Pvt Ltd., Director -
 Business Development, Ocean Robotix Pvt. Ltd.

Stated career in the Year 2014, Omniscient Electronics Pvt Ltd, Field
 Application Engineer to Product Manager (Semiconductor products),
 Business Development Manager (2018) (India).

Stated V3Novus Pvt. Ltd. in 2010. The business model was on both
 Distribution and design services with primary focus on Industrial




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	<p>Automation applications. Later in 2013 we diverted our focus to Develop our own products for Indian and overseas Military applications.</p> <p>Currently we have associated with more than 4 PSU's and DRDO Labs to cater their Design needs and also on custom product requirement for Military Market.</p> <p>Under Make in India program we have Developed many substitute for the import items where in Customers were facing a High price, long lead time and After sales support problems.</p> <p>Now V3Novus is a one of the growing MSME Company with Head Quartered in Bangalore. We have a team size of 27 people with in-House PCB design, Hardware Design, Firmware design, Application Development team to Cater Customer needs as a one stop solutions for their design and product needs.</p> <p>We are also exploring a possibility to work together with Research institutes to Develop many more products for our Market.</p>
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Talk Title: Sensors and Internet of Things

- About Sensors
- IoT
- Different types of commonly used Sensors in Industry
- Industry Trend
- Key growth market
- Market segments
- Power of IoT in sensor Technology
- Industry Challenges
- Opportunities

	<p>Swami Suparnanandaji, Secretary, Institute of Culture, Kolkata</p> <p>Swamiji was the principal of the Residential College, Narendrapur, West Bengal for almost 27 years. His discipline was Economics. He also served the Ramakrishna Mission Ashram, Narendrapur as the Secretary for three years. He then moved to the Institute of Culture, Golpark part, Kolkata as Secretary in 2013.</p>
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Talk Title: Value Education, Ethics, Yoga and Meditation

Abstract: Value education means Value in Education. Education gives us knowledge and knowledge is power. Education makes us powerful to handle power for the good of all. This should have been the goal. Acquiring knowledge is itself a great value in education. An educated person enjoys his power like a king.



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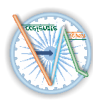
A king can do no wrong because he has muscle power to silence the critics; but he can do wrong to others at ease if he so likes when he refuses to hear the feeble voice of his own conscience. The moot point is that a king can control others, but cannot control himself, his greed, desire, anger, avarice and hence he is half of an ideal. On the other hand, getting proper education, a group of young educated people can deny earthly possession in their life and take to the path of the Rishis. But here also, a Rishi has some weaknesses. He can control himself, but he cannot control others. Therefore, a Rishi is also an imperfect ideal. So, a king and a sage both, in isolation of their respective fields of operation, are imperfect, both being half of an ideal. The complete ideal, therefore, before our students' community is the combination of the king and the Rishi or Rajarshi. It is not that the educated people will only go for wealth, name, fame, power and so on. They will equally be mindful to grow in compassion, sacrifice, service, love for others. We usually bless our past students saying: Keep well- 'Bhalo Theko'. It simply means live in the midst of lucrative jobs, enjoy and grow in the world like Kings. But Swamiji would say: You be as powerful as a king in the outside world but at the same time grow in love, sacrifice, service or grow in unselfishness. He blesses us to grow both within and without like a Rajarshi. This really means true Value in Education. A Rajarshi takes into account both economic and spiritual development.

We must not miss it in our education. Of course, we have to consider some other values also like: Dharma, Artha, Kama and Moksha. These four values summarise the Indian attitude towards life. (i) The life at its savage state is busy with Kama and Artha or Kanchan (Gold). Most of the western countries follow this twofold value. These are necessary values, no doubt, but obviously demonic ones. (ii) The life with developed state follows the three tier values of the combination of Kama, Artha and Dharma. Here people observe morality or Dharma in enjoying life. Kama or sensuous pleasure is allowed as per the dictates of moral principles. Similarly, earnings are to be made by honest means. (iii) But the cultured society takes up all the four together as (Chaturvarga): Dharma, Artha, Kama and Moksha. Moksha is liberation or God realization. This is the ultimate or final goal of humanity and the best of all values to those who understand it.

Now why Yoga? Reality being Divine, Yoga connects values with Reality. Yoga gives us the power to go beyond values and realize the Reality. Why meditation then? In fact, Yoga transforms value experience into mystic experience in Meditation.

Now a word about Values Vs. Ethos: We are usually fond of ethos. Ethos is not all good. It could be evil also. We know the evils of priestcraft, caste system, maintenance of Kulinya (Pedigree), even the joint family system etc. In fact, we had to suffer a lot for such ethos. Swamiji had to fight a lot against the evils arising out of the Ethos. He was even debarred from entering the Temple of Dakshineswar after his return from the West. Ethos of not crossing the black Sea was very much current then. It was Swamiji who broke it. Swamiji brought about drastic changes in the ethos of our attitude towards religion and life for the sake of social well-being, intellectual advancement, national integration, rejuvenation of religion and culture.

In our scriptures, especially in the Upanisad, this highest value Moksha has been portrayed well. In the Kathopanishad the story of Nachiketa vividly describes the power of detachment for the worldly possession. Nachiketa was simply a boy and asking for the knowledge of spirit beyond death from the God of Death. He was allured with the valuable things of the world but to no effect. Our students should be taught of this greatest goal of human life and not merely the bread-winning learning. The western countries have got their Ideal teacher only in Socrates who accepted death calmly because he knew he was deathless, immortal. The study of the life of Socrates has been mandatory in the Christian world. We, too, should bring the Nachiketa's life before our student population at one stage of their academic life.



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Dr M K Mondal, Associate Professor, Indian Institute of Technology Kharagpur

Dr. Mrinal Kanti Mandal obtained B. Tech. and M. Tech. degrees from the Institute of Radiophysics and Electronics, University of Calcutta in 2001 and 2003. PhD from the department of Electronics and Electrical Communication Engineering, Indian Institute of Technology Kharagpur in 2008.

From 2007 to 2009, he worked as a Research Fellow in the Institute for Infocom Research, Agency for Science, Technology and Research, Singapore. He also worked as a postdoctoral fellow in the Université du Québec à Montréal, Canada from 2009 to 2010 and in the École Polytechnique de Montréal, Canada from 2010 to 2012. He joined IIT Kharagpur as a faculty of department of E and ECE in 2012, where he is presently serving as an associate professor.

Dr. Mandal is a senior member of IEEE (2013). He is in the editorial board of Wiley International Journal of RF and Microwave Computer-Aided Engineering. He was in the board of organizing committee members of several international conferences including Asia-Pacific Microwave Conference – 2016. He obtained MHRD national scholarships for excellence in secondary and undergraduate examinations. He has authored or co-authored over 110 journal and conference papers including 40 in different IEEE journals in the domain of microwave and millimetre-wave circuits and systems. He has also filed 11 patents. His present research interest is co-design of active and passive components and their application in reconfigurable antennas, millimetre-wave imaging systems, beam forming networks, Doppler radars and six-port receiver.

Title: Frequency Modulated Continuous Wave (FMCW) Radars and its applications as industrial and biomedical sensor

Abstract: In a Frequency Modulated Continuous Wave (FMCW) Radar, a frequency modulated microwave signal is transmitted and then received from any reflecting objects. Individual objects are detected using the Doppler effect. A FMCW radar measures the speed and the distance of a target from the Radar. It can also measure vibration in continuous-wave mode. It is widely used as a radio-altimeter, proximity sensor, for structural health monitoring of aging infrastructures, to monitor human and animal vital signs, and as sport accessories etc. Measurement range is from a few feet to several kilometres.

The lecture will focus on the basic working principle of different block of a FMCW radar system, its advantages and disadvantages, some application examples, and current research trends. FMCW radar systems developed in the department of E and ECE, IIT Kharagpur will also be presented.



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Mr Parna Ghosh, Group CIO for UNO Minda Group

Mr. Parna Ghosh is working as Group CIO for UNO Minda Group. His total experience spans across 29+ years in reputed MNCs & Indian organizations in leadership capacities. He is 6 times winner of the coveted CIO 100 award and more than 50 prestigious awards in India for the last decade.

Prior to Uno Minda, he was associated in leadership positions with CNH Industrial, Honda Motorcycle & Scooters India, Tata Group (TACO) & Pricol and his background spans across manufacturing to service, distribution & retail industry. He is a distinguished speaker in various IT Forums on subjects ranging from Technology, Innovation, Digital Disruption & Business Transformation through IT. Associated with Uttarakhand Technical University as a guest lecturer for Faculty Development Programme.

He Represents various national forums in the capacity of driving IT in overall industry specifically automotive – he is a member of National Digital committee and Chairman for North Zone Digital Committee of ACMA, Member Governing Council of CII – Center for Digital Transformation, Member of Knowledge and Innovation Council, CIOs of India. He holds Post Graduate Degree in Information Technology from Karnataka University with bachelors from University of Calcutta. Holds Several Certifications - Performance and Leadership from Harvard Business School, Strategic Thinking certification from ISB, Innovative CIO certification from IIM Bangalore and Certification on Financial Management from IIT Delhi.

Talk Title: Use of Sensors and IoT Technology in automotive in this Digital Era

Abstract: IoT innovation made it possible to connect everyday things to the internet. Nowadays, almost all entities, such as houses, office buildings, factories, and even cities are connected to the network to collect data and utilize the information for various purposes.

The importance of data has increased greatly, with many experts saying “data is the new oil.” Sensors made it possible to collect data in any situation and are now used in various fields – automotive, medical care, nursing care, industrial, logistics, transportation, agriculture, disaster prevention, tourism, regional businesses and many more. With the expansion of the fields in which sensors play an important role, the market is still growing with a variety of sensors.

Sensors play an important role in creating solutions using IoT. Sensors are devices that detect external information, replacing it with a signal that humans and machines can distinguish. In the automotive sector, IoT has enabled greater transportation efficiency and management capabilities and is leading us to a future of intelligent, autonomous vehicles. In-vehicle infotainment: Smart apps are being baked into car infotainment systems to provide in-car navigation, telematics, and entertainment. An IoT system consists of sensors/devices which “talk” to the cloud through some kind of connectivity. Once the data gets to the cloud, software processes it and then might decide to perform an action, such as sending an alert or automatically adjusting the sensors/devices without the need for the user.



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Mr Varadarajan Krish, an angel investor and involved in the Global Startups Movement - The 100 Open Startups

Holds a Bachelors degree in Electronics & Communications Engg and a Post Graduate in Systems Management.

He is an executive turned serial tech entrepreneur with 5 exits including two IPOs.

Presently, an angel investor and involved in the Global Startups Movement - The 100 Open Startups. As a cofounder of this global movement, he is offering this program to all the stakeholders in the innovation ecosystem worldwide so that they can leverage it fro meet their goals and objectives. We are running several Grand Challenges that all the startups can apply and source business and investments.

He has been deeply involved with the highest funded IoT startup in the energy sector, WinAMR where together with its Founder Chairman built the end-to-end Smart Grids company from its inception to revenue stage from 2005 till date. As one of the Board of Directors of WinAMR, he drives the overall strategy for growth of the company.

Further he has completed with distinction the following programs

1. Technology Entrepreneurship and Startup Boards of Venture Labs
2. Advanced Entrepreneurship of Venture labs, Stanford University.
3. He also completed Leading Innovation -India Program of the Harvard University.

Specialties:

Innovation, Research, R&D, Intellectual Property, IP Valuation, Sustainable Innovation Models, Patents, Open Innovation, Open Startups, Corporate Innovation Strategies.

Talk Title: Smart metering the key efficient energy management in Smart Cities

Abstract: Smart meters exist for all essential services, from gas and electricity to water and temperature. To use this data effectively, the devices are connected securely to an IoT platform over the internet that collects and analyses the data.

Smart meters have gained quite a lot of popularity across the globe in recent years. Organisations are acknowledging the advantages of smart meters and adopting them to increase the efficiency and accuracy of utilities management. Companies globally have already announced investments of more than USD 62 billion for smart meter infrastructure, and Telefonica, for example, expects to see between 90 and 130 million intelligent electricity and gas meters deployed by 2022. Asian countries are positioning themselves as the leaders in this space: there is an ambition that by 2022, 70 percent of all homes in the region will be connected via smart meters. The EU has estimated that the replacement of 80% of current electricity meters by smart meters would reduce the region's carbon emissions by 9% by 2020 and bring down annual household energy consumption by a similar amount.



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List of participants who have successfully completed the course as per ATAL Academy rules

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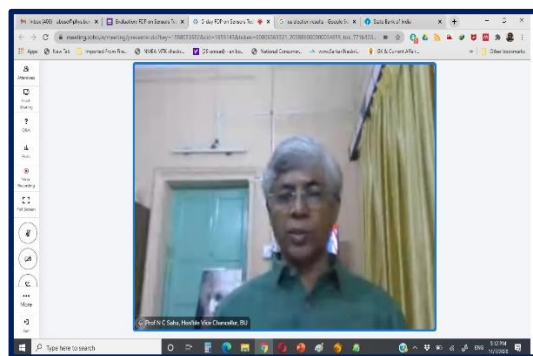
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Professor N C Saha, Hon'ble Vice Chancellor, The University of Burdwan delivered the valedictory address on 07/11/2020. He thanked AICTE for providing the opportunity to The University of Burdwan, DST for considering the program under Accelerate Vigyan program and all the experts for providing support to this program. He also congratulated all the participants.



Some of the feedbacks obtained from the participants through Google Form feedback Link are given below:

Participant	Comment
Dr Kamalika Tiwari	Speakers were very interactive. The program was very nicely organised .
Sadia Kaniz Fatima	This is best fdp which I have attended online. Because it includes theoritical knowledge as well as practical knowledge.it also provide interaction session and cultural program which is not done in any other fdp.
Dr. Saswati Dey	Overall the program was nicely arranged, however, I specifically want to praise the time management. All of the sessions were managed in time and therefore not being monotonous.
Dadaso Jaypal Shetti	Very useful and advanced information about sensor technology
Dr MD SHAMS NADEEM	Nice wonderful presentation round the week, Thanks a lot to the organizer to giving opportunity to be a part of this.
Praveen Vaidya	Addition of cultural program and talk on value and ethics
Veena Gaonkar	Anindya Bose sir @ Thanks for providing resourceful speakers throughout the 5 days FDP
Mugdha Dambhare	FDP was very nicely organized and I got a chance to explore field of sensors because of many eminent speakers presented

Many participants expressed their interest for more follow up programs on the topic

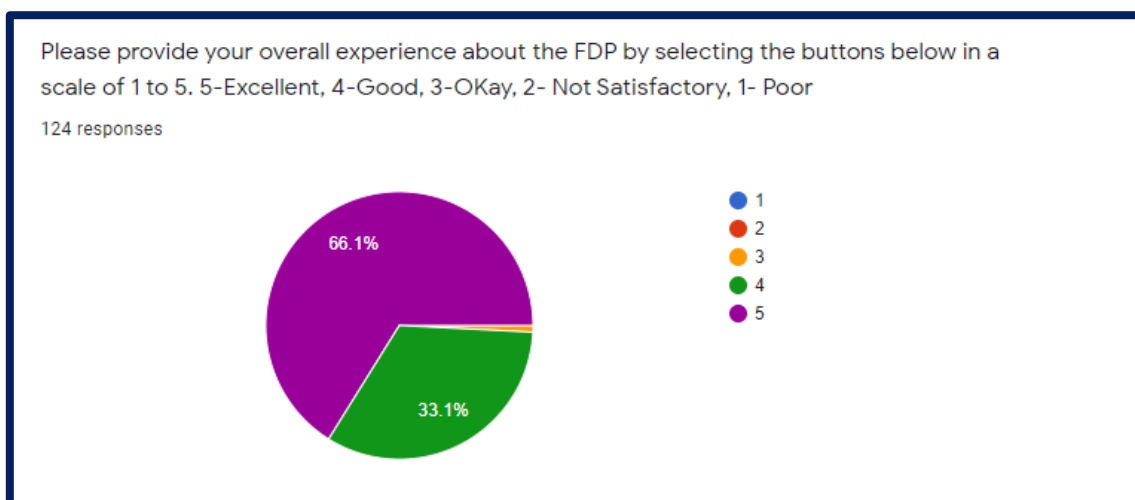
Some comments regarding the problems encountered/ what the participants disliked are:

- Timing a little bit longer (10:30-5:40)
- Zoho meeting platform is not user friendly
- The topic of few sessions were very new to me and the contents were also too much specific (research paper of the presenter) to a particular domain. I felt that one hour lecture session was not enough to grasp the idea, that the speaker wanted to deliver.

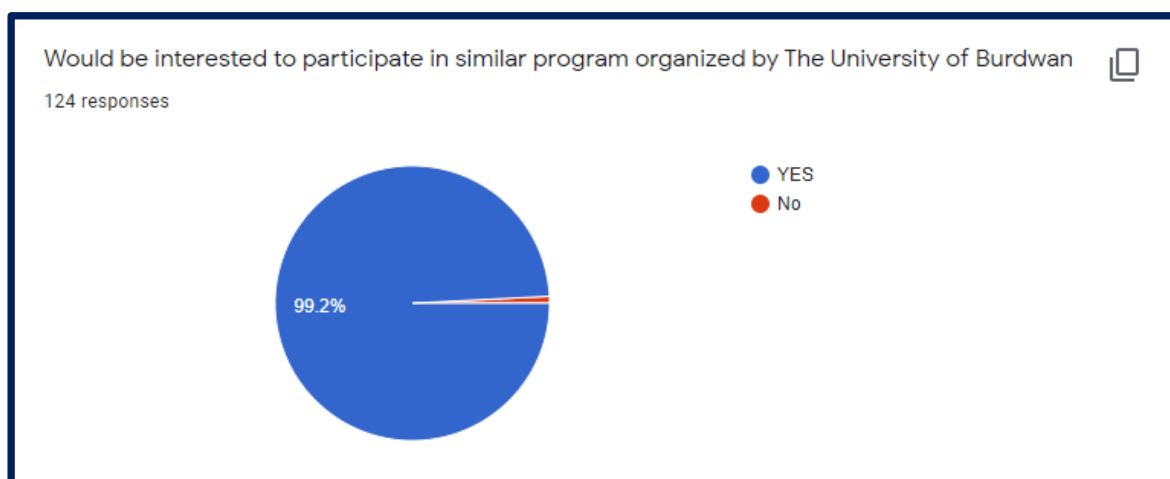
Overall experience of the participants: 66.1% of the participants who provided feedback graded the program with “Excellent” and 33.1% graded in as “Good”. Only 1 participant graded the program with “Good”. Screenshot of the analytics using the Google Form Link is given below.



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99.2% of the responding participants showed their interest to take part in similar events organized by The University of Burdwan.



The program was conducted through support from the following Local organizing Committee:

Patron	Prof N C Saha, Hon'ble Vice Chancellor, BU	
Advisors	Prof A Panigrahi, Hon'ble Pro Vice Chancellor, BU Prof P K Chakrabarti, Dean, Faculty of Science, BU Prof R K Sar, Dean, Faculty of Arts, BU Prof A Mazumdar, Registrar (Officiating), BU	
Members	Prof P Mitra, HoD, Physics, BU Prof B Ghosh Prof Sourangshu Mukhopadhyay Prof U Chatterjee Prof S Mukhopadhyay Dr A Dutta Dr R Das Dr (Mrs) C Hansda Dr A Roy Dr J Chakravorty, Treasurer	Prof S K Pradhan Prof S Das Prof A C Mondal Dr T Banerjee Dr A Chakraborty Dr R Kshetri Dr A Chowdhury Mr T Sarkar Dr Anindya BOSE, Coordinator

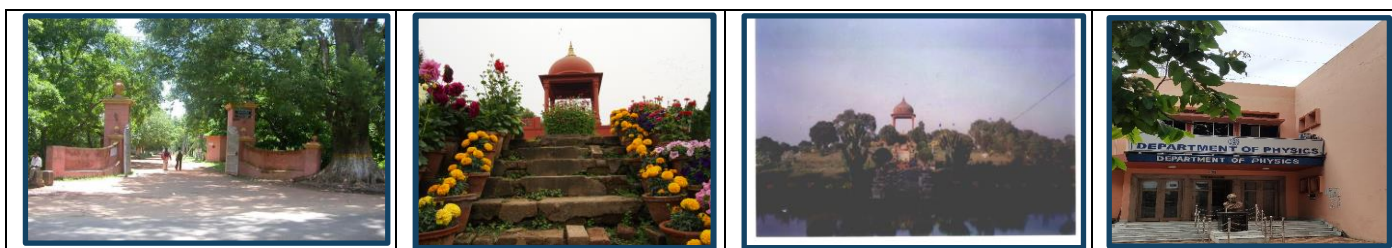


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The YouTube link for the technical Sessions are given below:

3/11/2020	Session 1: Dr Ramanna
	Session 2: Prof Dinesh Manandhar
	Session 3: Swami Divyanandaji
4/11/2020	Session 1: Prof P K Chakrabarti
	Session 2: Dr Surajit Kundu
	Session 3: Dr Abhishek K Jha
5/11/2020	Session 1: Prof M Jaleel Akhtar
	Session 2: Dr Shweta N Shah
	Session 3: Mr Omar Valdes
	Session 4: Dr D Biswas
6/11/2020	Session 1: Prof R Ghatak
	Session 2: Mr Hemanth Kumar H D
	Session 3: Swami Suparnanandaji
7/11/2020	Session 1: Prof M K Mondal
	Session 2: Mr Parna Ghosh
	Session 3: Mr Varadarajan Krish

The online Faculty Development Program was a great initiative from the AICTE Training and Learning (ATAL) Academy. The LoC is thankful to AICTE for providing us the opportunity to conduct online FDP for the faculty members, researchers and PG students of technical institute of India and representatives from Industry completely free of cost. We got encouraging response for registration as well as compliments of arranging the event, for proper management of the course, for the content and hands on session. The participants also expressed their interest to take part in similar events on the topic for more advance topic on Sensors Technology.



[24]



Anindya Bor.