

5-day FDP on GNSS/NavIC and Applications

21-25 September, 2021



REPORT



5 Day Faculty Development Program (FDP) **GNSS/ NAVIC AND APPLICATIONS**

AICTE Training and Learning (ATAL) Academy

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

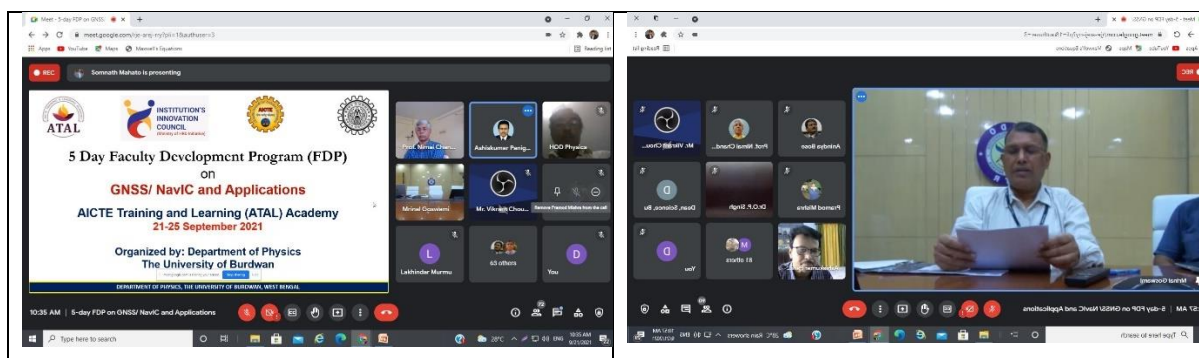
Date:
21-25 September, 2021
Contact: abose@phys.buruniv.ac.in

5-day FDP on GNSS/ NavIC and Applications
Organized by Department of Physics, The University of Burdwan, West Bengal
21-25 September 2021

5-day Faculty Development program (FDP) on GNSS/ NavIC and Applications was organized by The Department of Physics, The University of Burdwan, West Bengal during 21- 25 September, 2022. The program was sponsored by AICTE Training and Learning (ATAL) Academy.

The program is conducted completely online using Google` Meet Meet platform. Total 141 participants from different parts of India applied to participate in the course, 137 were selected to participate and 109 candidates successfully completed the course fulfilling the attendance and marks requirements stipulated by ATAL Academy. 13 experts from educational institutions, research organization, and Industry delivered lectures, one product showcasing session and one hands on training session was organized in the program. Out of all the experts, 9 experts were from India and 4 experts from other countries. There were total 14 technical sessions, 1 session on value and ethics, 2 inauguration and valedictory session, 1 Indian Industry presentation, 1 manufacturers` session and one GNSS hands on session. On the final day online evaluation was also organized. Dr Anindya Bose of Department of Physics was the coordinator of the FDP.

The program was inaugurated by Professor Nemai Chandra Saha, Hon`ble Vice Chancellor, The University of Burdwan. **Dr H K Ratha, Director, Integrated Test Range (ITR), DRDO, Chandipur delivered the Keynote address.** Other dignitaries present in the inaugural session were Professor Ashis Kumar Panigrahi, Hon`ble Pro-Vice Chancellor, The University of Burdwan, Professor P K Chakravarti, Department of Physics, Dean, Faculty of Science and 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 3.





5 Day Faculty Development Program (FDP)

AICTE Training and Learning (ATAL) Academy



GNSS/ NavIC and Applications

Lecture YouTube Links

Date/ Day	Session #1	Session #2	Session #3
21/09/2021	Inauguration and Keynote Address (Keynote Address by Sh H K Ratha, Director, ITR-DRDO, Min of Defence) https://youtu.be/DeZYVHWzUb0	Introduction to GNSS Dr Anindya Bose, BU https://youtu.be/XY5BIQgNYrA	GNSS and NavIC- Constellations, Applications and Research areas Sh Atul P Sukla, Former SAC, ISRO https://youtu.be/8xHjrn6VZvs
22/09/2021	(i) QZSS- history, current scenario and related issues and (ii) Concept of RTK, MADOCA-PPP, implementation, applications and low-cost RTK Dr Dinesh Manandhar, Tokyo Univ., Japan https://youtu.be/aNBu0Izais4	Galileo: history, development, current status and future Mr Rainer Horn SpaceTech Partners, Belgium https://youtu.be/lmLkELgNwBQ https://youtu.be/Dx0Gza6pYxU	GNSS Time Transfer Applications Dr P Banerjee, Former NPL, New Delhi https://youtu.be/IvD_ibVrwcE
23/09/2021	GNSS positioning techniques (SPS, PPP) and GNSS software receivers Dr Ivan Petrovski, ip-Solutions, Japan https://youtu.be/Aprxr8JP2eU	GNSS Error Sources, Interference and Multipath Issues Dr Shweta N Shah, SVNIT, India https://youtu.be/I8fRweFD_c0	GLONASS: Present Status and future Mr Alexei Zinoviev, NTLab, Lithuania https://youtu.be/pbb-D1eIxGI
24/09/2021	Value and Ethics in Education Swami Suparnanandaji, RKMIC, Kolkata https://youtu.be/84Oi0wfY4A0	GNSS Industry: Global and India Mr V Krish, IIRA, India https://youtu.be/wAD7XclvIGY Col V S Velan, Elena Geosystems, India https://youtu.be/PJ7PvNPik1Y	GNSS Industry: Product Showcasing by manufacturers NTLab, uBLOX, Leica, Trimble, V3NOVOUS https://youtu.be/rOfNkuBqgdc
25/09/2021	GNSS for Atmospheric Research Dr Nirvikar Dashora, NARL, Gadanki https://youtu.be/7C0Lr4Goz1o	NavIC for Atmospheric Research Dr Saurabh Das, IIT, Indore https://youtu.be/ufDJhRJ_sJU	GNSS Hands On GNSS Laboratory, Burdwan University https://youtu.be/rZPXqM-0EYU

Organized by

GNSS Laboratory, Department of Physics, The University of Burdwan, Golapbag, Burdwan 713 104, West Bengal

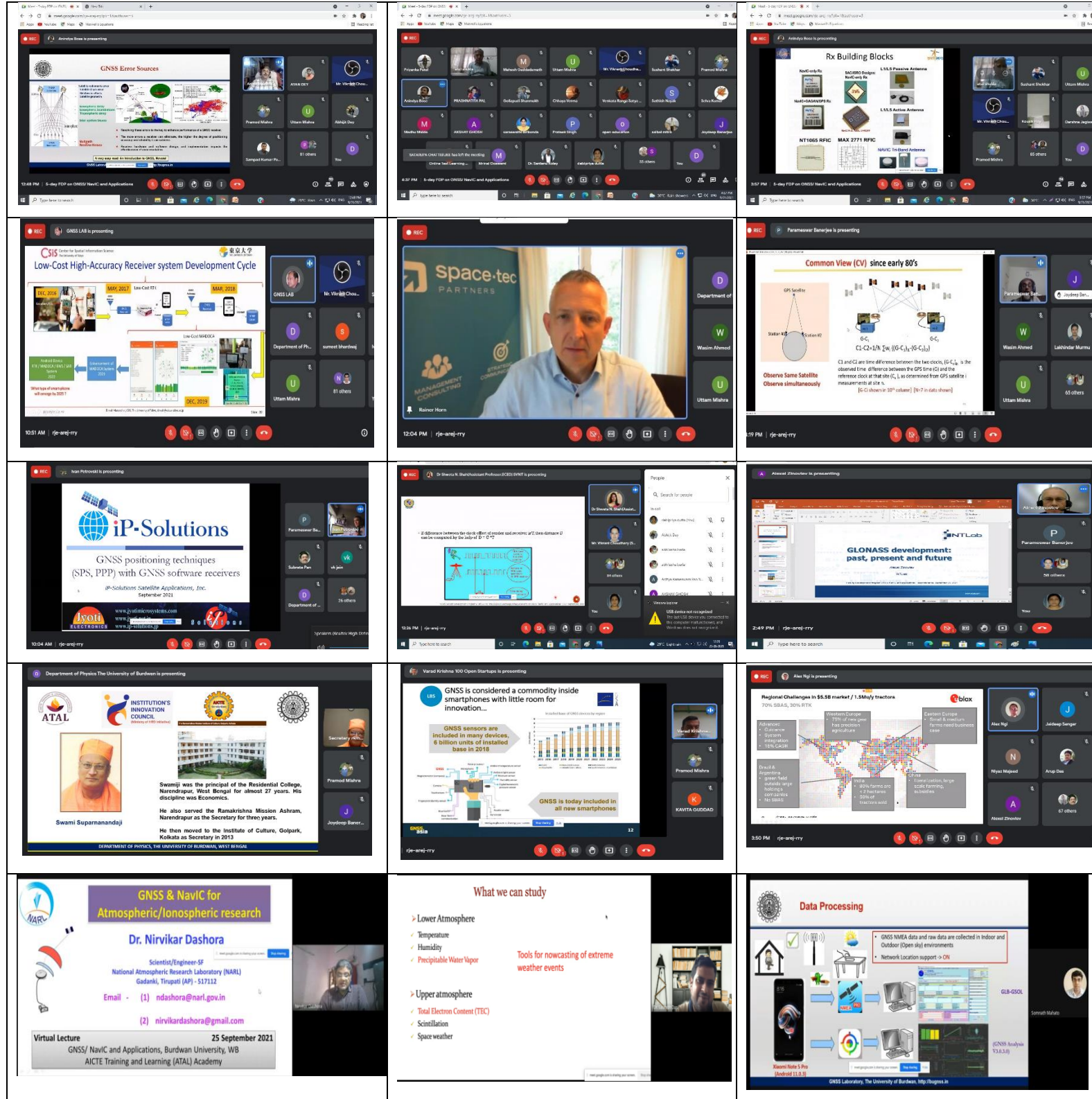
Web: <http://bugnss.in>

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Sample screenshots for each of the session during the event are shown below



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Speakers and Brief Bio



Dr Anindya BOSE, Senior Scientific Officer, Department of Physics, The University of Burdwan

- M Sc, M Phil and Ph D from The University of Burdwan
- Alumnus of International Space University (ISU), Strasbourg, France
- Started research career at NPL, New Delhi, India
- Working as Senior Scientific Officer, Department of Physics, The University of Burdwan since 1996
- Recipient of URSI Young Scientist Award
- Fellow, IETE; Member, URSI
- Main research interest – GNSS, NavIC, low-cost GNSS/ NavIC based application development
- Consultant to Indian GNSS Industry

Topic: Introduction to GNSS



Mr Atul P Sukla, Former Head, SNAA, Space Applications Centre (SAC), ISRO, Ahmedabad

- BE Electronics & Communication from L.D. Collge of Engg., Ahmedabad – 1982
- Served in Space Applications Centre from April 1983 to May 2021 and Superannuated as Group Director Navigation Technology & Applications from SAC/ISRO in May 2021.
- In ISRO, he worked in the field of Image-Processing, Satellite Communication, Tele-education and Satcom Applications. In the last 15 years he was actively involved in ISRO's Satellite Navigation development programme IRNSS.
- He contributed in development of IRNSS receiver, Simulator and Satnav Applications of IRNSS.
- He was the focal person for IRNSS Research and IRNSS Field trials activity in Association with Indian Academic Institutes.

Topic: GNSS and NavIC- Constellations, Applications and Research areas

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

- Dr. Dinesh Manandhar is an Associate Professor at The University of Tokyo, Japan.
- He has been working in the field of GPS and GPS related applications for the last 20 years.
- He designed IMES signal based on GPS/QZSS for indoor navigation.
- Dr. Manandhar is working in the field of GNSS signal authentication for the last 10 years.
- Currently, he is developing new signal structure for QZSS/GNSS signal authentication.
- He is actively involved in promoting GNSS technology and its applications in Asia by conducting trainings, workshops, webinars and pilot projects in coordination with universities, government organizations and UNOOSA/ICG

Topic: i) QZSS- history, current scenario and related issues and (ii) Concept of RTK, MADOCA-PPP, implementation, applications and low-cost RTK



Mr Rainer Horn, SpaceTech Partners, Belgium

Rainer Horn is a seasoned management consultant leading his own boutique consultancy, SpaceTec Partners, since 2009. His expertise spans across the space, mobility, and public sector with a particular focus on Global Navigation Satellite Systems (GNSS). Having successfully led the GNSS.asia programme for the past years, he facilitated industrial cooperation and economic diplomacy across Asia and Europe. During this time, he has been a renowned keynote speaker and panellist at conferences for GNSS, investment, technology, and institutional topics in Europe, the US, and Asia-Pacific. Moreover, he is an active member of the steering committee for Multi-GNSS Asia (MGA) along with several other institutional boards in space programmes in Europe and Asia. Throughout his career, he has shown to be an avid supporter of start-up and SME businesses, fostering innovation and entrepreneurship in the New Space sector. With this outstanding expertise in business development and insider knowledge about the European space sector, he is actively creating opportunities for start-ups that leverage EU Space data.

Mr Horn is the Global Coordinator of GNSS.asia, an EU funded project under Horizon 2020 running since 2012. GNSS.asia drives industrial cooperation across continents in the Multi-GNSS


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	<p>environment and has been very active in India organising Galileo Hackathons, start-up support programmes and GNSS Roundtables.</p> <p>Topic: Galileo: history, development, current status and future</p>
	<p>Dr P Banerjee, Former Head, Time and Frequency Section, National Physical Laboratory, New Delhi</p> <ul style="list-style-type: none">• Dr. P Banerjee is currently visiting Research Consultant of Physics department of Burdwan University.• Dr. P. Banerjee had been Professor in Department of Electronics and Communication Engineering in Amity School of Engineering & Technology (ASET), Amity University, NOIDA till December 2016.• He joined NPL in 1976 and had retired as Senior Deputy Director, Scientist G in 2011. He served as the Head of Electrical and Electronics Standard and Time Frequency Section of NPL.• Dr. P. Banerjee was officiating Director of NPL in 2009.• Dr. P. Banerjee was a member of Seventh Indian Scientific Expedition to ANTARCTICA during 1987-88.• He has more than forty years' experience in Design and Development of Analog and Digital Circuits, Microprocessors based system, Electronics instrumentations, Phase lock System, Time dissemination techniques via geostationary satellite, GPS, GLONASS and GNSS system and Generation of Time Scale, Timing Measurement system and analysis etc. <p>Topic: GNSS Time Transfer Applications</p>
	<p>Dr Ivan G Petrovski, iP Solutions, Japan</p> <p>Dr. Ivan G. Petrovski has been working in the GNSS field for more than 35 years. He has experience and expertise both in the academic field and in industry. His academic experience includes teaching as Associate Professor at the Moscow Aviation Institute – Technical University, as Guest Professor at Tokyo University of Marine Science and Technology in Japan, and as guest lecturer at Embry-Riddle Aeronautical College in the USA. He was Japan Science and Technology Agency Fellow with the National Aerospace Laboratory (now JAXA), and has led GNSS R&D in DX Antenna Inc. and GNSS Technologies Inc.</p> <p>He is an author of numerous papers (ION Best Paper Award), articles in the journals GPS World and Inside GNSS, as well as a number of</p>

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	<p>patents. He is a member of the advisory board for the journal GPS World. He is author of two books published by Cambridge University Press. Currently, he leads GNSS product development at iP-Solutions Inc. for the benefit of academia and the research community.</p> <p>Topic: GNSS positioning techniques (SPS, PPP) and GNSS software receivers</p>
	<p>Dr Sweta N Shah, Assistant Professor, Sardar Vallabhbhai National Institute of Technology Surat (SVNIT)</p> <ul style="list-style-type: none">• 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 <p>Topic: GNSS Error Sources, Interference and Multipath Issues</p>

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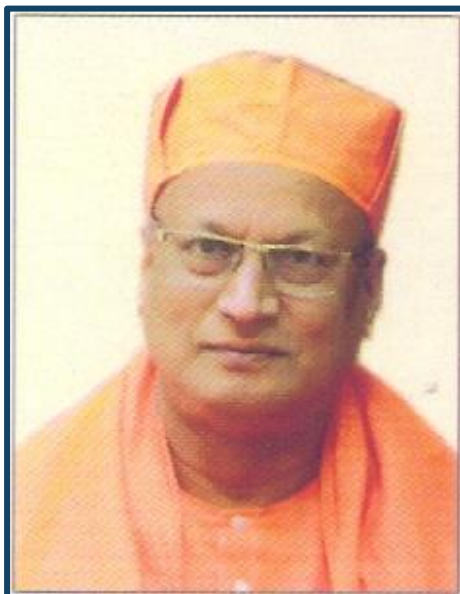
Mr Alexi Zinoviev, NTLabs, Lithuania



- Alexei Zinoviev graduated from Moscow Institute of Engineers for Geodesy, Aerial Surveying and Cartography (MIIGAiK), Russia.
- He joined Institute for Space Device Engineering in Moscow in 1988 where he worked for GLONASS development.
- Since 1993, Alexei worked at Ashtech and Javad Positioning Systems, then at Topcon Positioning Systems as the Head of GNSS Firmware Development.
- In 2018, he joined NTLab where he occupies the position of Chief Designer, GNSS Algorithms.
- Also, Alexei participates in the development of GNSS standards: he is the Chair of two Working Groups of RTCM SC-104: GLONASS and NavIC/IRNSS.

Topic: GLONASS: Present Status and future

Swami Supannanandaji Maharaj, Secretary, Ramakrishna Mission Institute of Culture, Golapark



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, Kolkata as Secretary in 2013

Topic: Value and Ethics in Education

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	<p>Mr Varadarajan Krish, IIRA</p> <ul style="list-style-type: none">• 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. Please visit www.winamr.com for details.• 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 <p>Topic: GNSS Industry: Global and India</p>
	<p>Lt Col V S Velan, Elena Geosystems, Bangaluru</p> <ul style="list-style-type: none">• Lt Col Velan, is a Subject Matter Expert in Satellite Based Navigation and Monitoring. From 2008, he has been part of mission to achieve Atma Nirbharta in the Global Navigation Satellite Systems domain.

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- He sacrificed a successful career in the Armed Forces to pursue R&D in this subject from 2011. He is sponsored Doctoral student of IIT Kharagpur. He is an ardent learner with two MSc Degrees, two Management Degrees, couple of Diplomas and Certification Courses.
- He founded Elena Geo Systems in 2012 in the Technology Business Incubator of IIT Kharagpur to support R&D in NavIC Domain. Elena is in the forefront in this technology and is supplying solutions to the defence and the public in the country. More details can be had from <http://www.elenageosystems.com>.
- Expertise:
 - Design and Development of GNSS-based navigational equipment
 - Design and development of monitoring solutions for corporates
 - Development of Geo Enterprise Resource Management Systems based on Geoinformatics.

Topic: GNSS Industry: Global and India

Dr. Nirvikar Dashora, Scientist-SF at National Atmospheric Research Laboratory, Gadanki, Andhra Pradesh




- He joined NARL in year 2007 after his PhD. His PhD work has been one of the first from India on “Study of ionospheric TEC and Scintillation using GPS observations”. He has been the first from India to publish the GPS TEC and scintillation study in year 2005. He is M. Sc. in Physics and M. Tech. in Space and Atmospheric Science.
- At NARL, he has been developing a ground network of GPS receivers for high resolution remote sensing and imaging of ionosphere. His main research interests are Space Weather effects and ionospheric variability over equatorial and low latitudes.
- He has published more than 40 papers in peer-reviewed international journals and presented more than 50 papers at various national/international conferences.
- With the advent of Indian NavIC system, he aims to develop scientific applications of this uniquely configured constellation along with GPS/GNSS using ground and Satellite based experiments.
- He has been convening a series of workshops on GNSS/NavIC applications and has delivered more than 30 invited lectures on this subject at various workshops/symposia.

Topic: GNSS for Atmospheric Research




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	<p>Dr Saurabh Das, IIT, Indore</p> <ul style="list-style-type: none"> Dr. Saurabh Das received his Ph.D in Radiophysics and Electronics, University of Calcutta and M.Sc. in Physics from IIT Roorkee. Currently he is an Assistant Professor at Discipline of Astronomy, Astrophysics and Space Engineering, IIT Indore. Earlier he worked as an Assistant Professor at University of Calcutta and as an INSPIRE Faculty at Center for Soft Computing Research, Indian Statistical Institute and IIT Indore. He was recipient of two Young Scientist awards from International Union of Radio Science (URSI) in URSI-GASS, Beijing, China and AP-RASC, Seoul, South Korea. He has published 24 peer reviewed papers in reputed international journals. He also served as PI of three externally funded projects. His current research interests includes GNSS, remote sensing, wave propagation, radar meteorology, and machine learning applications in atmospheric science problems. <p style="color: red; text-align: center;">Topic: NavIC for Atmospheric Research</p>
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Hands on Session Demonstration by

Dr Anindya Bose and

		
Mr Atanu Santra, SRF	Mr Somnath Mahato, SRF	Mr Sukabya Dan, SRF
GNSS Laboratory, The University of Burdwan (GLB): http://bugnss.in		

Manufacturers' Session Participants

<u>NTLab, Belarus</u>	<u>Hexagon Geosystems India</u>	<u>uBLOX</u>	<u>Trimble India</u>	<u>V3Novus, Bangaluru, India</u>
Dr Alexey Zinoviev	Mr Jaideep Senger Mr Arup Das	Mr Alex Ngi Mr Niyax Mazeed	Mr Sanjeev Trehan	Mr Hemanth R

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

Participant	Comment
Darshna Dipen Jagiwala	The workshop was very informative and helpful for the GNSS researchers.
Santanu Deb	It was a good international workshop. In future also kindly arrange this type of workshop.
Dinesh Mute	I want to visit your LAB and also want to work with your LAB
N Santhosh	Want to participate in offline mode
Rubeena Khan	Definitely want an offline workshops
Uttam Kumar Mishra	Very informative program on GNSS



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Prateek Singh	Please let us know, If such programs will be organized in future.
Raj Gusain	Please organize these type of FDPs in future where satellite communication and navigation technology is discussed.

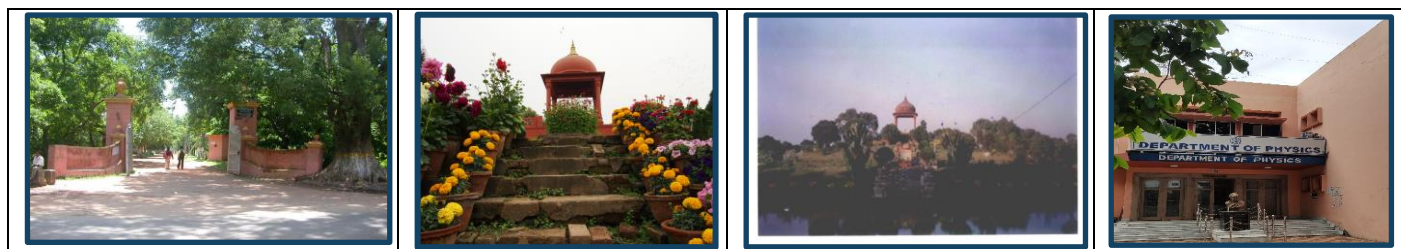
Many participants expressed their interest for more follow up programs on the topic

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 Dr D Mondal, 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

The YouTube link for the technical Sessions are embedded in the program schedule (Page 3) and GNSS Laboratory Burdwan (GLB) website: <http://bugnss.in>

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.



Anindya Bose