



Annual Report 2022-23



*Indian National Academy
of Engineering*



Foreword

At the outset, I take this opportunity to convey my greetings and warm wishes to the Former Presidents, Council Members, Fellows, Foreign Fellows, Young Associates, and Officials of INAE for a happy, healthy, and prosperous year ahead. As you are all aware, INAE is facing an unprecedented and most unfortunate crisis due to the directive of the Government for disengagement of DST from INAE. This decision implies that the financial support to INAE will be reduced systematically and will completely stop w.e.f. March 31, 2025. In spite of this huge crisis looming large, we have reasons to be proud that INAE has conducted all its flagship and major events with aplomb maintaining high standards of technical content, outreach and impact across the nation. I am also delighted to inform you that INAE has initiated a multitude of new initiatives with support from the Science and Engineering Research Board (SERB) that have made a mark in the engineering community cutting across age groups and disciplines.

As informed earlier, subsequent to the launch of Azadi ka Amrit Mohotsav by the Government on 12th March 2021, the then Secretary, of DST took a meeting with all the Autonomous Professional Bodies under DST on the same day and advised each one to draw a detailed plan for a grand celebration of India's 75th anniversary of Independence until 15th August 2022 which was extended to August 2023. The grand finale to this activity was the National Release of the Compendiums on "Landmark Achievements in Engineering and Technology in Independent India" and "Women Engineers in India Vol 1", both prepared under the aegis of the Azadi ka Amrit Mahotsav celebrations of India's 75th year of Independence launched by Government of India. These two volumes were released by Dr Jitendra Singh, Hon'ble Minister of State (Independent Charge) for the Ministry of Science and Technology & Earth Sciences during the National Science Day Function 2023 organized by DST, Govt. of India at Vigyan Bhawan on February 28, 2023, in presence of the Principal Scientific Advisor (PSA) to Govt. of India Prof. Ajay Kumar Sood; Prof K Vijay Raghavan, former PSA to Govt. of India; Dr S Chandrasekhar, the then Secretary, DST and other senior dignitaries. INAE plans to make the Compendiums available for ordering by individuals and organizations at national and international levels through an appropriate marketing agency.

On the 36th Foundation Day on 20th April 2022, INAE organized a Function wherein the Chief Guest was Dr. PS Goel, Former President, INAE who delivered an address on "INAE's Future Direction" followed by brief talks by selected office bearers of INAE. This was followed by a Distinguished Panel Discussion on "Opportunities and Challenges of Implementation of National Education Policy (NEP) 2020 for Engineering Disciplines and Profession" chaired by Dr K Kasturirangan, Former Secretary, Department of Space; Former President of INAE and Chairman NEP 2020 Drafting Committee. The overarching objective of this entire exercise was to formulate actionable recommendations on the theme for the successful



implementation of NEP 2020 in realistic stages and timelines through the concerned stakeholders in the Government Agencies, Academic Institutions, Industry, and R&D Organizations. A comprehensive set of steps that are required to be taken were enumerated in the report which emerged out of this discussion and set the tone for further deliberations which were followed up with concerned Government Departments/ stakeholders for furtherance of the initiative.

Post-pandemic, the activities of INAE were resumed in physical or hybrid mode. INAE organized the 16th National Frontiers of Engineering (NatFoE) Symposium jointly with Jadavpur University and in collaboration with IIT Kharagpur in June 2022. This annual flagship event of INAE was organized at the Salt Lake campus of Jadavpur University and was attended by young researchers across various academic institutions, R&D laboratories, and industries as speakers and participants. It was a physical event organized after a long period of lockdown due to the COVID pandemic and drew a huge enthusiasm from all quarters – participants, organizers, and INAE Fellows and office bearers. The four themes of the event were Field-Deployable Miniaturized Sensors; Waste Valorisation and Circular Economy; Resource Constrained Translational Technologies and Resource Constrained Translational Technologies. NatFOE-2022 was followed by a one-day National Competition on Innovation in Manufacturing Practices (IMP 2022) at Jadavpur University, Kolkata to provide a platform for engineering students and practitioners to compete in an All-India Contest to highlight innovations in the manufacturing sector.

The 5th INAE Youth Conclave 2022 was organized by INAE in collaboration with IIT Jodhpur under the aegis of the “SERB-INAE Conclaves on Atmanirbhar Technologies - Engineering Secured Future” initiative at IIT Jodhpur campus in September 2022 which was well attended by INAE Fellows, Young Associates and Engineering Students from across the country. Similarly, Engineers Conclave 2022 (EC-2022) was organized and was held jointly with the Indian Space Research Organization (ISRO) in October 2022 at the Liquid Propulsion Systems Centre (LPSC-ISRO), Thiruvananthapuram. The two themes for Engineers Conclave-2022 (EC-2022) were: Theme I on “Space for National Development” coordinated by ISRO, and Theme II on “Transforming India into a Global Manufacturing Hub” coordinated by INAE. About four hundred eminent experts and senior functionaries from National and State Centres/ Departments/ Units, Academia, R&D, Industry, and INAE participated in the conclave and the event was an astounding success. Actionable recommendations emanating from the deliberations were compiled and followed up with the concerned Government Departments/Agencies for consideration.

The INAE Annual Convention 2022 was organized and was held in December 2022 at Bhabha Atomic Research Centre (BARC), Mumbai in physical mode. Two Special Sessions on Compendiums by INAE, viz., “Women Engineers in India Vol. I” and “Landmark Achievements in Engineering and Technology in Independent India” were held wherein the Committee Members participated and shared their experiences on the journey of preparing the documents. The report on the Study on “Housing in India – Challenges & Way Forward” incorporating all inputs from invited experts was also released during the Annual Convention.

INAE organized an online event to commemorate Engineers’ Day celebrations on 15th September 2022, wherein Dr G Sathesh Reddy, FNAE, Scientific Advisor to Raksha Mantri, Ministry of Defence, Govt. of India, delivered a distinguished lecture on “Towards Atmanirbhar Bharat - Role of Engineers”. The President of INAE moderated this panel discussion session.

INAE conducts several unique activities and programs with the objective of fostering the growth of engineering and technology in the country. Besides organizing the annual events, INAE undertook several novel



initiatives noteworthy being the newly instituted SERB-INAE Collaborative Initiative in Engineering. As an outcome, various events were organized under the following four initiatives undertaken under the umbrella of ‘Collaborative Initiative in Engineering’ viz SERB-INAE Conclaves on Atmanirbhar Technologies - Engineering Secured Future; SERB-INAE Woman Engineers Program; SERB-INAE Outreach Programs for NE, J&K and Ladakh and SERB-INAE Innovation Hackathon. INAE has received a tremendous response and the initiative has progressed well, with the conduct of various events effectively, under all four verticals. As is now known, INAE is recognized as a professional peer group for various government and professional bodies because of this, INAE conducts several joint consultations, surveys, and reviews and offers actionable recommendations on engineering interventions as important outcomes of these activities, studies, and events to these agencies for implementation. In this regard, new joint Consultative Committees were constituted and operationalized with SERB in the last year. INAE now has eight joint Consultative Committees with DST, AICTE, DAE, DRDO, Office of PSA, SERB, CSIR, and ISRO several Meetings were held, and commendable progress was made.

An important initiative undertaken by the Academy under the aegis of the Azadi ka Amrit Mahotsav celebrations is bringing out a Report of the Committee on “Technological Preparedness for Dealing with National Disruptions”. India is prone to many natural and man-made disasters and INAE taking note of the unprecedented Covid Pandemic, felt that there is a need to enhance the technological preparedness of the nation to face these national disruptions/disasters of different types and formulate engineering interventions to cope with to such calamities. Therefore, a number of committees with domain specialists with the primary aim to examine the technology preparedness of the country to face such exigency was undertaken, overseen by a Peer Committee chaired by Dr PS Goel, former President, INAE and Formerly Secretary, Ministry of Earth Sciences and Chairman, Earth Commission and Director, ISRO Satellite Centre, Bangalore. The Report of the Committee on “Technological Preparedness for Dealing with National Disruptions” details the exercise of understanding the sources and nature of such disasters, identifying the gaps and recommending the engineering/technological solutions to be implemented by various agencies. It is believed that once these recommendations are implemented, the country will be better prepared to face these disasters, natural or manmade, in dealing with and reducing loss of life and property. The said report was also released nationally during the National Science Day Function 2023 by the Chief Guest, Dr Jitendra Singh, Hon’ble Minister of State (Independent Charge) for the Ministry of Science and Technology & Earth Sciences.

Digitization of activities is an ongoing mandate of the Academy. The drive to establish and implement the INAE Digital Platform to facilitate INAE Fellows submitting nominations online for election to Fellowship for improved functioning and coordinating operations of the INAE Office has enhanced its utility and effectiveness. INAE Office functioned normally and all online meetings and selection of Fellows went as per schedule. At this juncture, I thank the Members of the INAE Digital Platform Committee for strengthening the Academy with this timely intervention. I am also grateful to the Members of all Committees and Fora, especially the ten Sectional Committees who participated and fulfilled their commitment with utmost sincerity and helped the Academy maintain its professional excellence in a timely and efficient manner

You may recall that INAE being a Member-Academy of the International Council of Academies of Engineering and Technological Sciences (CAETS) routinely participates in its programmes and convocations of global concern at national and international levels. INAE undertakes joint initiatives with several CAETS Member Academies. In this connection, a series of collaborative activities were organized jointly between INAE and the National Academy of Engineering of Korea (NAEK), South Korea since 2017. To continue with the tradition, the fifth Workshop “Advanced Materials for Sustainable Development”



was held in August 2022 at Kolkata in hybrid mode which was a marvellous success. In the year 2022, CAETS Annual meetings were hosted by the National Academy of Technologies of France (NATF) in Versailles, near Paris, France. The International Conference on “Engineering a Better World: Breakthrough Technologies for Healthcare” was held in September 2022 and INAE Delegation participated in the event. INAE had nominated Experts for various Technical Sessions during the event. During the event, the winners of the CAETS Communication Prizes were also announced and it is a matter of pride that Prof Jayanta Mukhopadhyay, FNAE, IIT Kharagpur was conferred with the CAETS Communication Prizes 2022 in the Category “High Potential Innovations” with the title of entry “iMediXcare Telemedicine System”. The CAETS Council had requested the President, INAE to Chair the CAETS Engineering Education Working Group (EEWG) for which consent has been given by INAE. The CAETS 2022 Energy Report on “Towards Low-GHG Emissions from Energy Use in Selected Sectors” was released during the event. Several INAE Fellows had actively contributed to the preparation of the said report by being Members of the CAETS Energy Committee.

The “Transactions of Indian National Academy of Engineering – International Journal of Engineering and Technology” has increased in its outreach and visibility and a number of Foreign Fellows have since been taken on board as Editors of the journal.

An important highlight of the last year is the conduct of a large number of topical and interesting webinars conducted by the INAE Local Chapters. I place on record our deepest appreciation for the exemplary contributions by the Local Chapter Committees in undertaking these initiatives and conducting activities and webinars all of which were rich in technical content and had wide participation and generated positive feedback.

The Abdul Kalam Technology Innovation National Fellowship launched by INAE jointly with DST through SERB and aimed at promoting translational research leading to development of innovative technology, is progressing each year with the receipt of high-quality nominations. Ten eminent nominees were conferred the subject Fellowship during this year. A total of forty-five awardees have been selected for conferment of this prestigious Fellowship since its inception. Seven fellows from this select list of awardees have been granted extension of tenure up to five years after due review.

The Frugal Innovation Nurturing Programme (FINP) set up by the Academy to promote grassroots level innovations has recorded very impressive progress. INAE would continue to support the initiative in an advisory role on an honorary basis without financial outlay to promote the spirit of engineering innovation at the grassroots level to accrue direct benefit to society.

The Academy is enriched due to the active and significant contributions of the Fellows and Young Associates. As you all are aware, INAE is presently facing a crisis for its sustenance following the notification served by the Department of Science and Technology (DST) on 6th May 2022 conveying the direction of the Department of Expenditure, Government of India (GoI) that the Government would disengage itself from the activities of INAE including discontinuing the annual financial support w.e.f. 31st March 2025. In the wake of the DST’s decision to stop funding to INAE, the Academy made concerted efforts to reach out to various high-level Government officials and others, to convince and reconsider the decision of disengagement. In addition, parallel efforts to evolve a strategy and action plan to ensure sustainability and financial and functional autonomy are also being made by INAE. Several Committees have been constituted with senior INAE Fellows and Industry leaders to help overcome this crisis accrue revenue for self-sustenance and



continue its contributions to the growth of engineering and technology in the national and international fora. I shall periodically address the Fellowship online, to sensitize all of the crisis and request for individual donations and concerted efforts to generate funds from various other sources. Also, periodically an e-letter be forwarded to the Fellowship for making contributions online for the Corpus Fund through the INAE portal. All Fellows are requested to continue their efforts towards attaining financial sustainability of INAE and individual donations matched by efforts in this direction to reach out to corporate houses and industry leaders for generating resources for the Corpus Fund are the need of the hour. Several Fellows have kindly contributed to INAE as individual donors and letters of Income Tax exemption have been provided to them. INAE is also in the process of instituting Institutional Membership and Corporate Membership with benefits to Members in various categories. A number of positive responses have been received in this front which are being progressed further.

I commend the wisdom of the former Presidents of INAE in taking the technical activities and programs of the Academy to greater heights of excellence. The contributions of the Fellows and Young Associates are thankfully acknowledged as their response to INAE's call has always been overwhelming. I am delighted by the exemplary response of the Fellows and Young Associates who are ever willing to spare their valuable time in furtherance of the activities and programs of INAE. I look forward to continued and dedicated support in the future years, especially in these special circumstances, and am confident that with active support and contributions the Academy shall flourish as before with renewed enthusiasm and vigor, and the Academy shall be robust not only in technical activities but also sound in resources and attain self-sustenance. Please do feel free to revert with your suggestions and ideas and I shall be delighted to welcome your initiative and commitment.

Jai Hind!

Indranil Manna
President, INAE





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About the Academy

The Indian National Academy of Engineering (INAE), founded in 1987, comprises India's most distinguished engineers, engineer-scientists and technologists covering the entire spectrum of engineering disciplines. INAE functions as an apex body and promotes the practice of engineering and technology and the related sciences for their application to solving problems of national importance. The Academy provides a forum for futuristic planning for country's development requiring engineering and technological inputs and brings together specialists from related fields as may be necessary for providing comprehensive solutions to the needs of the country.

INAE is the only engineering Academy in India. INAE is a Member of the International Council of Academies of Engineering and Technological Sciences (CAETS). The aims and objects of the Academy are given below.

- a. To promote and advance the practice of engineering and technology and the related sciences and disciplines (hereinafter referred to as 'Engineering') in India and their application to problems of national importance.
- b. To disseminate among its members information on all matters pertaining to 'Engineering' and to encourage, assist and extend knowledge and information connected therewith by publishing such proceedings, journals, memoirs, and other publications as may be desirable and hold meetings, lectures, seminars, symposia etc.
- c. To interact, after due and detailed consideration, with professional bodies, engineering and scientific academies etc. already established or as may be established in future in India and abroad.
- d. To promote and safeguard academic and professional interest of persons involved in 'Engineering' (hereinafter referred to as 'Engineer' in India by laying down a code of ethics which shall be an obligation to be signed by all Fellows of the Academy on admission thereto).
- e. To provide an association of eminent 'Engineers' and to present at all academic forums research and developmental activities on 'Engineering' on mutually interactive and cooperative basis, both in India and abroad.
- f. To promote the National Policy on Education of the Government of India as announced from time to time, in all matters of technical education where the Academy is concerned.
- g. To assist the Government of India, the Local Governments, All India Council of Technical Education, and others in analysing, forecasting for the purpose of planning and formulating the policies in respect of education in 'Engineering' and ensuring the appropriate standard thereof.
- h. To offer the Government of India, the Local Governments and others, facilities for conferring with and ascertaining the views of 'Engineers' as regards matters directly or indirectly pertaining to 'Engineering' and to confer with the said Governments and others in cooperation with other fraternal professional bodies in regard to all matters pertaining to 'Engineering'.
- i. To encourage inventions, investigations and research and promote their applications for development of both organised and unorganised sectors of the national economy.



- j. To encourage and promote the pursuit of excellence in the field of 'Engineering'.
- k. To institute and establish Professorships, Fellowships, Studentships, Scholarships, Awards and other benefactions and to grant Certificates of Competency and Charter whether under any Act of Government of India or otherwise howsoever.
- l. To do all such other acts and things as are incidental or conducive to the attainment of the above objects or any one of them.

INAE Governing Council for the Year 2023



President

: Prof. Indranil Manna, Vice Chancellor, Birla Institute of Technology (BIT), Mesra, Ranchi, Jharkhand [On lien from I.I.T. Kharagpur, W.B.] and Former Director, Indian Institute of Technology Kanpur, U.P.; Former Director, CSIR-Central Glass & Ceramic Research Institute (CGCRI), Kolkata.



Immediate Past President

: Dr. Sanak Mishra, Member of the Governing Board of the Steel Research & Technology Mission of India. Formerly Managing Director, Rourkela Steel Plant and Director, Steel Authority of India Ltd. (SAIL); Vice-President, ArcelorMittal and CEO India Projects; Secretary General, Indian Steel Association; President, Indian Institute of Metals.



Vice-President (Finance & Establishment)

: Prof. UB Desai, Professor Emeritus, Formerly Dean (Students Affair), IIT Bombay; Formerly Professor, Department of Electrical Engineering, Indian Institute of Technology, Mumbai; Former Director, Indian Institute of Technology, Hyderabad



Vice-President (Academic, Professional & International Affairs)

: Prof. AB Pandit, J.C. Bose National Fellow, UGC Research Scientist, Professor and Vice Chancellor, Institute of Chemical Technology, Mumbai.



Vice-President (Fellowship, Awards & Corporate Communication)

: Prof. Sivaji Chakravorti, Professor, Electrical Engineering Department, Jadavpur University, Kolkata and former Director, NIT Calicut.



Chief Editor of Publications and GC Member affiliated to Engg Section-III

: Prof. Amit Agrawal, Professor, Department of Mechanical Engineering, Indian Institute of Technology Bombay, Mumbai.



Members



Engg Section-I

: Mr. VN Heggade, Former CEO of STUP & Former ED of Gammon, India, Mumbai.



Engg Section-II

: Prof. Subhasis Chaudhuri, Director, Indian Institute of Technology Bombay, Mumbai.



Engg Section-IV

: Prof. GD Yadav, Emeritus Professor of Eminence, ICT and JC Bose National Fellow, Former Vice Chancellor & R.T. Mody Distinguished Professor, Institute of Chemical Technology; Former Tata Chemicals Darbari Seth Distinguished Professor of Leadership and Innovation; Conjoint Professor, University of New Castle, Australia; Adjunct Professor, RMIT University, Australia; Adjunct Professor, University of Saskatchewan, Canada.



Engg Section-V

: Dr. Archana Sharma, Outstanding Scientist, Director, Beam Technology Development Group, BARC, Mumbai.



Engg Section-VI

: Prof. Anurag Kumar, Former Director, Indian Institute of Science, Bangalore.



Engg Section-VII

: Dr. Tessy Thomas, Former Distinguished Scientist & Director-General, Aeronautical System, Defence Research and Development Organisation (DRDO), Bangalore.

Members



Engg Section-VIII

: Dr. Debashish Bhattacharjee, Vice President, Technology & New Materials Business, Tata Steel, Kolkata.



Engg Section-IX

: Prof. Rangan Banerjee, Director Indian Institute of Technology Delhi & Formerly, Forbes Marshall Chair Professor, Department of Energy Science and Engineering, Indian Institute of Technology Bombay, Mumbai.



Engg Section-X

: Prof. Kripa Shanker, Visiting Professor, Mechanical Engineering Department, Indian Institute of Technology (BHU) Varanasi.

Representatives of Various Organisations



Department of Science & Technology (DST), Ministry of Science & Technology

: Prof. Sushmita Mitra, Professor HAG, Machine Intelligence Unit, Indian Statistical Institute, Kolkata.



Ministry of Education (Erstwhile MHRD)

: Prof. Bhaskar Ramamurthi, Former Director, IIT Madras and Professor, Dept of Electrical Engg, IIT Madras



Department of Space (DOS)

: Dr. VR Lalithambika, Former Distinguished Scientist and Director, Directorate of Human Space Programme, ISRO, Bangalore.



All India Council for Technical Education (AICTE)

: Dr. Rajeev Shorey, Chief Executive Officer (CEO), University of Queensland – IIT Delhi Academy of Research (UQIDAR), IIT Delhi.



Representatives of various Organisations



Indian National Science Academy (INSA) : Prof. V Ramgopal Rao, Pillay Chair Professor in EE Department and Former Director, Indian Institute of Technology Delhi, New Delhi.



Defence Research & Development Organisation (DRDO) : Dr. BHVS Narayana Murthy, Distinguished Scientist and Director General Missiles & Strategic Systems, Office of the DGMSS, Hyderabad.



Department of Atomic Energy (DAE) : Mr. RN Jayaraj, Formerly Chairman & Chief Executive, Nuclear Fuel Complex, Department of Atomic Energy, Hyderabad.



Confederation of Indian Industry (CII) : Dr. Ashish Mohan, Head-Technology, Innovation, IPR, and Design, Gurgaon.



Federation of Indian Chambers of Commerce & Industry (FICCI) : Mr. Shyam Bang, Chairman, FICCI Taskforce on Manufacturing Excellence, FICCI, New Delhi.



The National Association of Software and Services Companies (NASSCOM) : Mr. Siva Prasad Polimetla, Head- ER&D Initiative, NASSCOM



INAE Committees

Sectional Committees

The composition of the ten Sectional Committees is given below.

Sectional Committee-I

(Civil Engineering)

Convener

Prof Subrata Chakraborty

Members

Mr. Alok Bhowmick

Prof. MC Deo

Dr. SK Gupta

Prof. PP Mujumdar

Prof. CSP Ojha

Prof. Ligy Philip

Mr. N Raghavan

Mr. B Rajaram

Dr. VN Sharda

Dr. N Subramanian

Prof. R Sundaravadivelu

Sectional Committee-II

(Computer Engineering and
Information Technology)

Convener

Prof. PJ Narayanan

Members

Prof. Sanghamitra Bandyopadhyay

Prof. Naveen Garg

Dr. Lipika Dey

Prof. Niloy Ganguly

Dr. Suparna Bhattacharya

Prof. Ujjwal Maulik

Prof J Mukhopadhyay

Dr. H Ramesh

Dr. Ramachandran Ramjee

Prof. Rajeev Sangal

Prof. S Sudarshan

Sectional Committee-III

(Mechanical Engineering)

Convener

Dr. Dasharath Ram

Members

Prof. Souvik Bhattacharyya

Prof. Amitava Datta

Prof. Anindya Deb

Prof. Suhas S. Joshi

Prof. S Khandekar

Dr. Sathya Prasad Mangalaramanan

Dr. NC Murmu

Prof. Naresh Tandon

Dr. C Ranganayakulu

Mr. Atul Sobti

Dr. K Velusamy

Sectional Committee-IV

(Chemical Engineering)

Convener

Prof. S Narasimhan

Members

Prof. KG Ayappa

Prof. JR Bellare

Prof. Anurag Mehra

Prof. KK Pant

Dr. JS Raut

Prof. R Rengasamy

Dr. CV Rode

Dr. Ajit V Sapre

Ms. Vartika Shukla

Prof. PK Tewari

Prof. SN Upadhyay



Sectional Committee-V

(Electrical Engineering)

Convener

Prof. IN Kar

Members

Prof. Laxmidhar Behera
Prof. Saikat Chakrabarti
Dr. Chandan Chakraborty
Prof. Baylon G Fernandes
Prof. K Gopakumar
Prof. Mahesh Kumar
Mr. SK Soonee
Mr. RN Nayak
Dr. AP Tiwari
Mr. AK Tripathy
Prof. L. Umanand

Sectional Committee – VII

(Aerospace Engineering)

Convener

Dr. S Pandian

Members

Mr. MV Dhekane
Prof. HB Hablani
Prof. G Jagadeesh
Prof. Mira Mitra
Dr. BHVS Narayana Murthy
Dr. Debasis Chakraborty
Dr. Samikkanu Raja
Prof. K Sudhakar
Dr. Ramesh Sundaram
Mr. MS Suresh
Dr. L Venkatakrishnan

Sectional Committee-VI

(Electronics & Communication Engineering)

Convener

Prof. Debatosh Guha

Members

Dr. Tinku Acharya
Prof. M Balakrishnan
Dr. S Christopher
Prof. Nandita Dasgupta
Prof. RD Koilpillai
Dr. Lalit Kumar
Dr. Chandrakanta Kumar
Mr. Raghavan Muralidharan
Dr. Ishwardutt Parulkar
Dr. CP Ravikumar
Prof. M Shojaei Baghini

Sectional Committee – VIII

(Mining, Metallurgical and Materials Engineering)

Convener

Prof. NK Mukhopadhyay

Members

Prof. Kantes Balani
Dr. Harish C Barshilia
Dr. Biswajit Basu
Prof. K Chattopadhyay
Dr. Indranil Chattoraj
Mr. Debashis Deb
Dr. RN Ghosh
Dr. R Gopalan
Prof. Jyotsna Dutta Majumdar
Prof. Ashok M Raichur
Dr. Satyam Suraj Sahay

Sectional Committee-IX

(Energy Engineering)

Convener

Dr. Shashank Chaturvedi

Members

Mr. AK Balasubrahmanian

Dr. Bibek Bandyopadhyay

Prof. Rangan Banerjee

Dr. Suddhasatwa Basu

Prof. Debabrata Das

Dr. Anuradda Ganesh

Dr. LM Gantayet

Mr. MS Unnikrishnan

Dr. BK Nashine

Dr. AK Nayak

Prof. Chandra Venkataraman

Sectional Committee-X

(Interdisciplinary and Special Engineering Fields
and Leadership in Academia, R&D and Industry)

Convener

Prof. Soumyo Mukherji

Members

Mr. NM Dube

Prof. PK Jain

Mr. AS Kiran Kumar

Prof. Giridhar Udapi Rao Kulkarni

Prof. Sandeep Verma

Dr. Sharmila S Mande

Prof. Samir K Pal

Dr. DR Prasada Raju

Prof. C Rajendran

Dr. SSV Ramakumar

Prof. DD Sarma



subject to any change in situation for awards
subject to reinstating of scheme by AICTE

Other Committees and Forums

DST-INAE Consultative Committee

Co-Chairs

Dr. Srivari Chandrasekhar
Prof. Indranil Manna

Members from DST

Dr. KR Murali Mohan
Dr. Anita Gupta

Members from INAE

Dr. Sanak Mishra
Dr. BN Suresh
Prof. UB Desai
Prof. AB Pandit
Prof. Sivaji Chakravorti
Prof. V Ramgopal Rao
Member-Secretary – Deputy Executive Director/
Executive Director, INAE

CSIR-INAE Consultative Committee

Co-Chairs

Dr N Kalaiselvi
Prof. Indranil Manna

Members from CSIR

Dr Venkata Mohan
Dr L Venkatakrishnan
Dr Naresh Chandra Murmu
Dr Soumitra Tarafder
Dr Vibha Malhotra Sawhney

Members from INAE

Prof. AB Pandit
Prof. Sivaji Chakravorti
Prof. SK Bhattacharyya
Prof. Gautam Biswas
Prof. Santanu Chaudhury
Prof. HS Maiti
Member-Secretary – Deputy Executive
Director / Executive Director, INAE

PSA-INAE Consultative Committee

Chairman

Prof. AK Sood

Members

Prof. Indranil Manna
Dr. Sanak Mishra
Dr. BN Suresh
Dr. PS Goel
Dr. Pradip
Prof. AB Pandit
Prof. Sivaji Chakravorti
Mr. Shirish Panda (Member from office of PSA)
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New Initiatives during the Year

I. SERB-INAE Conclave on ‘SERB Online and Digital Gaming Research Initiative’

Science and Engineering Research Board (SERB) launched “SERB – INAE Online and Digital Gaming Research Initiative” to leverage Digital Gaming research and industry in India. Digital Gaming industry being a fast-growing sector globally, Government of India desires to achieve self-reliance in advanced Augmented Reality (AR)/ Virtual Reality (VR) technologies to create indigenous gaming platforms for a number of applications ranging from education to leisure with the backdrop of Indian Ethos for desktop and hand-held devices. A Letter of Intent was signed by INAE with SERB in this regard during March 2022.

A conclave was organized on July 20, 2022 in physical mode in New Delhi to brainstorm on the present scenario of Digital Gaming Research in India and to get recommendations based on which “Call for R&D Proposals” can be made. Experts from Academia, Start-ups and Industry participated in the event by invitation. Forty delegates joined the conclave from Academia, Industry and Start-ups besides SERB team and INAE team.



Delegates along with SERB and INAE Team members

The event started with an Inaugural session wherein Prof Sandeep Verma, Secretary, SERB during his address highlighted the research initiative in gaming and how digital gaming can make a difference in learning patterns in education and efforts for making indigenous leisure gaming platforms. Subsequently, Prof Indranil Manna, President, INAE during his address gave an introduction about INAE and brief on Gaming industry status in India. He also emphasized on collaboration of Academia and industry in this initiative. The Inaugural session concluded with an address by Prof Santanu Chaudhury, Director, IIT Jodhpur. During his address, he highlighted technologies available and research in the field of gaming in India. The opening session was started by Dr Shailja Vaidya Gupta, Sc ‘G’, DBT & Formerly Senior Adviser, Office of PSA. She briefed on the need for indigenous games and statistics on the usage of different platforms in India. Shri Vipin Sondhi, Chairman, CII National Committee and Mission on Technology, Innovation and Research gave insights of CIIs involvement in the gaming industry and the limitations of the industry and how academia and industry can work hand in hand, for making a robust indigenous platform.



Left to Right: Prof Sandeep Verma, Prof Indranil Manna and Prof Santanu Chaudhury in Opening Session



Opening Session in Progress



Opening Session in Progress- Dignitaries on Dais

Subsequently, three sessions were organized on R&D in Learning, Educational, and Leisure Online Gaming Platforms; Digital Game Design with a focus on Indian Culture & Values and Development of Indigenous Technology platforms and applications.

Session I: R&D in Learning, Educational, and Leisure Online Gaming Platforms

Prof. Kavita Vemuri, IIIT Hyderabad moderated the session and Prof. G. Nagarjuna, Former Professor and Principal Investigator of ‘gnowledge’ lab, HBCSE, TIFR; Dr Sandeep Athavale, Lead Scientist, TCS Research and Innovation; Ms. Shruti Verma, Business Lead -India/SEA, Epic Games deliberated on the application of digital games in Learning and Education.



Part I- Digital games in Learning and Education

The second part of the discussion was focused on Leisure games where the major deliberation was on developing games from Indian epics, stories, building game assets, skills required, and the development & integration of Indian language and speech engines. Mr. Harish Chengaiah, Founder, Game Director and Producer, Outlier Games; Mr. Vaibhav Chavan, Founder and CEO, underDOGS Gaming Studio; Mr. Chirag Chopra, Founder & Creative Director, Lucid Labs and Mr. Lokesh Suji, Director, Esports Federation of India also participated in this session.



Part II- Leisure games



Session II: Digital Game Design, with focus on Indian Culture & Values

Prof Nitin Gupta, IIT Kanpur moderated the session and participants were Dr. Kavita Vemuri, IIIT Hyderabad; Dr. Avinash Sharma, IIIT Hyderabad and Mr. Rahul Sehgal, Founder and MD, Roach Interactive Pvt. Ltd. The deliberations were focused on technical challenges in the following aspects:

- Reconstruction of human body movement with oriental clothing.
- Problem in Realistic and 3D figure generation.
- Dearth of structured game design course and lack of proper mentoring.
- Lack of understanding of human behaviour.
- How to involve industry into games which are developed in academic labs.



Session II- Digital Game Design, with focus on Indian Culture & Values

Session III: Development of Indigenous Technology platforms and applications

The session was moderated by Prof. Santanu Chaudhury, Director, IIT Jodhpur. Experts from Academia including Prof. Parag Chaudhuri, IIT Bombay; Prof. Subodh Kumar, IIT Delhi and Prof. C.V. Jawahar, IIIT Hyderabad deliberated on “Technology Needs and Open Problems for developing games with Indian Ethos”. This was followed by a panel discussion on “What Technology Support is needed for developing Games with Indian Mythological and Heritage Contexts: Industry Perspective” with participation of experts from startups, academia and industry. The participants from startups were Mr. Harish Chengaiah; Mr. Vaibhav Chavan; Mr. Chirag Chopra and Mr. Rahul Sehgal. The Experts from academia were Dr. Amit Bhardwaj, Associate Professor, IIT Jodhpur; Dr. Uma Mudenagudi, Professor, KLE Technological University, Hubli and Dr. Rajendra Nagar, Assistant Professor, IIT Jodhpur. Dr. Anupama Mallik, Founder, CEO & MD, Vizara Technologies Pvt Ltd; Mr. Ajit Padmanabh, Founder and CEO, WhoVR and Mr. Manas Bairagi, CEO, iHUB-Drishti participated as Industry representatives.



Session III- Development of Indigenous Technology platforms and applications

The conclave was successful and different dimensions of gaming research and industry perspective were discussed. The recommendations from the deliberations were the basis of formulating the ‘Call for Proposals’ thereafter.

A Call for well-defined proposals on the following thematic areas concerning online and digital games were invited through INAE Website and was also published in leading national newspapers, besides forwarding to INAE Fellows, Young Associates, Directors of IITs, NITs and CFTIs and AICTE for further dissemination. The call for proposals was open from October 10, 2022 till December 15, 2022 on the following themes.

- Category (I): R&D in Learning, Educational, and Leisure Online Gaming Platforms
- Category (II): Immersive Game Prototypes, with a focus on Indian Culture & Values
- Category (III): Collaborative Technical Design Process: Creation of SERB Game Labs

Proposals were particularly invited from:

- Scientists in regular service from educational and research institutes / laboratories/ universities, start-ups and industries. More than one academic partner was allowed.
- Ideally from a consortium and should be an industry-academy (including start-ups) collaboration with IP creation as a priority.
- Investigators already having a SERB project.
- Multidisciplinary teams involving technologists, designers, historians and experts in other areas of humanities and social sciences were encouraged for the project.

Forty-three proposals had been received for selection for execution subsequently based on the merit of the proposal and guidelines thereof. The number of proposals received under each category are as given below:

- Category (I): R&D in Learning, Educational, and Leisure Online Gaming Platforms --17 proposals
- Category (II): Immersive Game Prototypes, with a focus on Indian Culture & Values—15 proposals
- Category (III): Collaborative Technical Design Process: Creation of SERB Game Labs—11 proposals



Out of total 43 proposals received, twelve proposals were provisionally ineligible and one duplicate proposal was received. In order to have the common understanding for effective evaluation of the proposals received, a meeting of Program Management Advisory Committee (PMAC) for SERB-INAE Online and Digital Gaming Research Initiative was convened on April 6, 2023 in hybrid mode. The proposals would be selected by the concerned experts from SERB and INAE based on the methodology to be suggested during the meeting.

II. Online Expo of Innovations by Start-ups in India - INAE-NIT Calicut Online Exposition of innovations in Indian Startups

INAE and National Institute of Technology Calicut jointly organised an online exposition contest to showcase the innovative Indian Start-ups in view of the Azadi Ka Amrit Mahotsav celebrations marking the 75th year of Indian Independence. To solicit participation from across the country in the expo, NIT Calicut and INAE had invited five organisations in the field of innovation promotion to collaborate for this event. The five organizations associated with this online Exposition were:

1. National Innovation Foundation (NIF)
2. Kerala Startup Mission (KSUM)
3. Startup Innovation and Incubation Centre (SIIC), IIT Kanpur
4. CIIE.CO (IIM Ahmedabad Incubation Centre)
5. Maharashtra State Innovation Society

This expo provided a platform for Indian start-ups in five significant sectors – (i) Agriculture Technology, (ii) Skilling and Livelihood, (iii) Digital Healthcare, (iv) Clean Mobility and (v) Waste to Wealth; to showcase their innovations virtually using short videos (~ 5 min.). These five sectors are relevant to the current national goals of the Government of India. It was decided that Cash prizes of Rs. 50,000 and Rs. 25,000 were awarded to the winners and runners up of each sector.

The brochure launch of Online Exposition of Innovation by Startups in India was held at National Institute of Technology, Calicut on 7th February 2022. The brochure was launched by the Director of NITC, Dr. Prasad Krishna and Prof Sivaji Chakravorti, Vice-President, INAE. The news related to the event was published in the national newspaper “The Hindu”.

From the 44 entries received, 31 innovative ideas were shortlisted after the preliminary evaluation and were displayed in the virtual expo from 1st - 3rd April 2022, where the viewers were able to post creative comments and cast a vote (like) for one video from each sector. The viewers could interact with the innovators during the interactive session as part of the expo and the link for this was published in the portal. The expo was inaugurated by the Prof. Indranil Manna, President, INAE. Prof. Sivaji Chakravorti, Vice-President, INAE; Prof. Sathidevi, Deputy Director of NIT Calicut and Prof. Jeevamma Jacob, Registrar of NIT Calicut also participated in the inaugural session.

There were 2375 viewers who logged in in the site. There were 1062 comments received for the innovations displayed and received 1659 likes altogether for the 31 innovations. Interactive sessions with the innovators were arranged on both 1st and 2nd April 2022 evening for the viewers. In these sessions, the innovators presented more details on the innovations exhibited in the portal. The evaluation of the innovations was done by experts from the innovation and entrepreneurship sector viz Prof. Swarnendu Sen, Professor of

Jadavpur University (and the coordinator of the innovation activities in the university), Dr. Raghavendra Prasad (former Exe. Director of PSG STEP and an entrepreneur) and Shri. Nizamuddin Mohammed (CEO of Maker Village, Kochi) were the evaluators for the expo. While deciding the winners, along with the marks awarded by the evaluators, the weightage for the votes (likes) received also taken into consideration.

In the valedictory session conducted on 3rd April 2022 which was presided over by the Prof. Prasad Krishna, Director of NIT Calicut; Prof. Sivaji Chakravorti, Vice-President, INAE announced the winners of each of the sector. The details of the winners are given below:

- a. **Agriculture Technology:** First prize to Cococubes International Foods & Beverages Pvt. Ltd for the product Natural Healthy Energy Drink from Coconut and second prize to Neerx Technovation Pvt. Ltd. for the innovation SHOOL: Smart Sensor for hydrology and land Application.
- b. **Skilling and Livelihood:** First prize was given to the innovation IP Buddy (One stop solution for all your IP needs).
- c. **Digital Healthcare:** Medgyor Pvt Ltd won the first prize for the innovation Affordable isolation room for burns and MIRTH was given the second prize.
- d. **Clean Mobility:** Silov Solutions Pvt. Ltd won the first prize for the innovation Smart, Green and intelligent EV charger and RaptorX received the second prize.
- e. **Waste to Wealth:** Mr. Jayaprasobh JP won the first prize with the innovation Coco Bio composites for daily use plastic and wood alternative applications.

Shri. Rajiv NP, Vice Chairperson of National Innovation Foundation addressed the innovators during the valedictory session and explained the importance of innovation and opportunities for the startups especially from the grass root level. The event was unique in nature and met the envisaged objectives of promoting innovative indigenous technologies.

New Joint Consultative Committee

- **SERB-INAE Consultative Committee**

Collaboration established with Science and Engineering Research board (SERB), DST and a new SERB-INAE joint Consultative Committee was constituted with the objective to meet and decide on areas of mutual interest.



Joint Activities with SERB

SERB-INAE Collaborative Initiative in Engineering

INAE jointly with SERB had taken a new initiative during the year 2022 to conduct various events under the newly instituted SERB-INAE Collaborative Initiative in Engineering. As an outcome, various events were organized under the following four initiatives undertaken under the umbrella of ‘Collaborative Initiative in Engineering’.

- a. SERB-INAE Conclaves on Atmanirbhar Technologies - Engineering Secured Future
- b. SERB-INAE Woman Engineers Program
- c. SERB-INAE Outreach Programs for NE, J&K and Ladakh
- d. SERB-INAE Innovation Hackathon

INAE had received a tremendous response and the initiative has progressed well, with the conduct of various events effectively, under all the four verticals. In this regard, the events/programs that had been organized during the year 2022-23 under the umbrella of “Collaborative Initiative in Engineering” as given below:

a) SERB-INAE Conclaves on Atmanirbhar Technologies - Engineering Secured Future

- (i) **SERB-INAE Conclave:** INAE Kanpur Local Chapter, under the aegis of SERB-INAE Conclaves on Atmanirbhar Technologies - Engineering Secured Future initiative organized a two - day conclave on 5-6, November 2022 at IIT Kanpur. The conclave primarily focused on the following three themes: Clean Energy and Carbon Capture; Medical technology, implantable devices, and non-invasive imaging and Semiconductor technology and the future of electronics. The conclave was well attended. A total of 83 participants from outside IITK joined the conclave. They included students and faculty members from colleges all over the country. All the talks and panel discussions were live-streamed on YouTube and the links are given below for viewing the same.

Day 1 - <https://youtu.be/PkupNo3v9X8>

Day 2 - <https://youtu.be/rWZZKtET-F4>

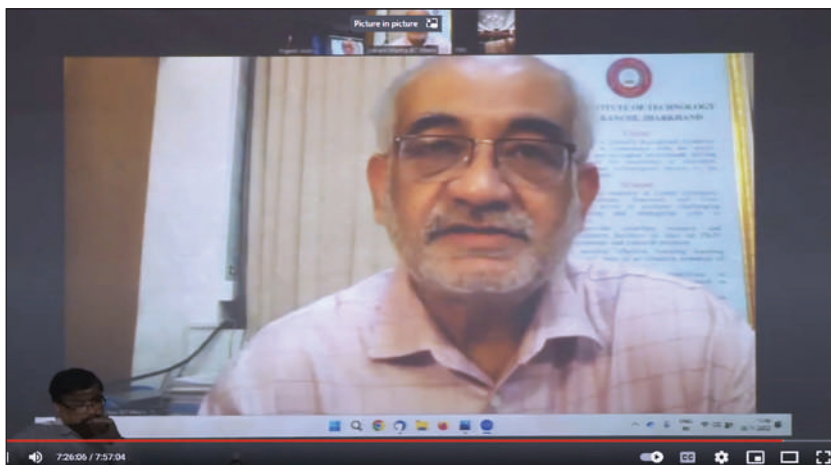
The event covered Plenary talks by eminent engineers, Panel Discussion, Student competition, etc. Prof Ashutosh Sharma, Former Secretary, Department of Science and Technology (DST) while speaking to the participants as the Chief Guest, emphasized the importance of science and engineering to address the future needs effectively; while Prof. Abhay Karandikar, Director, IIT Kanpur, threw light on the conclave. A large number of participants from all over India, including students, faculty members, and start-ups, took part in the conclave organized at IIT Kanpur in hybrid mode.

The event comprised of plenary and technical lectures by eminent dignitaries. In addition, a panel discussion session was held on “Driving India forward through Frugal Innovations” to highlight the

importance of frugal ideas and the means to take them forward for commercialization on the themes. Student competitions were planned on innovative products - prototypes, great ideas, challenges, and ideation of start-ups; to cater to the aspiring minds of college students and start-ups. The shortlisted teams were invited to participate in-person at the event in IIT Kanpur, and the winners among them were awarded. Prof Indranil Manna, President, INAE, briefed about the background of the collaboration of Science and Engineering Research Board with INAE through various initiatives. He also emphasized the role of INAE to promote and advance the practice of engineering and technology and to identify and recognize top engineering professionals in the country. The event concluded with the speech by Prof. Amalendu Chandra, DoFA, IITK, who distributed the prizes to the winners.



Prof Ashutosh Sharma, Former Secretary, DST, & Chief Guest addressing the participants



Address by Prof Indranil Manna, President, INAE during Valedictory Session

Seven invited excellent talks, spread across the two days, oriented towards the conclave's theme, were held. The List of speakers and titles of their talks are given below:

- Prof. V. Ramgopal Rao, Department of Electrical Engineering, IIT Delhi on Semiconductor Technology
- Prof. Ashutosh Sharma, Department of Chemical Engineering, IIT Kanpur, on Being Atmanirbhar from Invention to Innovation: Challenges, Opportunities and Processes of the Brave New World



- Prof. Vishwanath Prasad, University of North Texas Discovery Park, TX, USA on Clean Energy: Is there a choice
- Prof. Milind Atre, Department of Mechanical Engineering, IIT Bombay, Mumbai on Development of Multistage Pulse Tube Cryocoolers to cool the I-R detector
- Prof. Pramod P Kulkarni, NSB-NTPC School of Business, Noida, UP on Clean Energy and Carbon Capture
- Prof. Neetu Singh, Center of Bio-Medical Engineering, IIT Delhi on Medical Technology
- Prof. Niraj Sinha, Mechanical Engineering, IIT Kanpur on Medical Technology, Implantable Devices, and Non-Invasive Imaging

To encourage active participation of students and start-ups; three competitions were held on Innovative products –prototypes; Grand ideas challenge and Ideation of Start-ups. A total of 120 team entries were received. After shortlisting, 16 teams presented their work. All presentations were high in technical content. The conclave ended with the prize distribution and valedictory session was graced by Prof. Amalendu Chandra, Dean of Faculty Affairs IITK and Prof. Indranil Manna, President INAE who joined through zoom and addressed the gathering.

Snapshots of the INAE-SERB Conclave on Atmanirbhar Technologies: Engineering a Secure Future





INAE-SERB Conclave on Atmanirbhar Technologies Engineering a Secure Future -Group Photograph

b) SERB-INAE Woman Engineers Program

(i) Workshop on Writing R&D Grant Proposal for Women Engineers

Towards the direction to encourage women engineers in the country to undertake research and seek funding for their research proposals, an initiative had been taken by INAE and SERB, DST to jointly organize a Workshop on “Writing R&D Grant Proposal for Women Engineers” which was held on November 10-11, 2022 at IIT Tirupati.



Prof Sivaji Chakravorti, Vice-President, INAE delivering the Inaugural Address

The Workshop started with welcome address by Prof KN Satyanarayana, Director, IITT. Prof Sivaji Chakravorti, Vice-President, INAE & Professor, Electrical Engineering Department, Jadavpur University, Kolkata was the Chief Guest of the event. During his inaugural address he mentioned that today teaching and research goes hand in hand and to bridge the heterogeneous gender gap, it is essential to encourage women engineers to undertake research for which seeking funding is a prime factor. A book on “Research Insights” authored by Dr Rajiv K Tayal, Formerly Scientist-G, DST, who was also the Resource person for the Workshop, was released during the Inaugural Session.



L to R: Prof Sivaji Chakrvaorti, Prof KN Satyanarayana, Dr Rajiv K Tayal and Dr DR Prasada Raju during the book release on “Research Insights”

Around 35 Women faculty/researchers in Engineering disciplines from Engineering/Technological Institutions/Universities from the states of Andhra Pradesh, Karnataka, Kerala, and Telangana participated during the event. The workshop covered important aspects such as Research insights; Funding of research; evaluation of research grants; Role of funding agencies; Type of research grants; Evaluation of research grants; writing research grants; contents of proposal; formulation of proposal; defending a research grant; implementation of research grants and group activities by participants. Special lectures on Project based learning and specific funding opportunities were also delivered by Prof Sivaji Chakravorti and Dr DR Prasada Raju, Former Scientist, DST. Besides, technical sessions, various group activities to inculcate confidence in women engineers on writing an effective R&D grant proposal to seek funding from the government agencies, were also conducted over the span of one and half day Workshop.



Group photograph of all the participants

A Certificate of participation to the candidates was presented by Prof G Ranga Janardhana, Vice Chancellor Jawaharlal Nehru National Technological University (JNTU), Anantapur who was the Chief Guest for Valedictory Session held on November 11, 2022.

(ii) SERB-INAE Workshop on “Writing R&D Grant Proposal for Women Engineers” held at IIT Gandhinagar on February 23-24, 2023

SERB-INAE Workshop on “Writing R&D Grant Proposal for Women Engineers” was organized at IIT Gandhinagar on February 23-24, 2023. Dr DR Prasada Raju, FNAE and Dr RK Tayal, FNAE were the Coordinators of the event from INAE. The workshop was aimed at women faculty and researchers in engineering from engineering and technological institutions/universities in Goa, Gujarat, Madhya Pradesh, Maharashtra, and Rajasthan. The workshop was organized with the objective of encouraging women engineers across the country to undertake research and pursue funding for their research proposals. The engineers who attended the workshop were provided with valuable insights on research funding, evaluation of research grants, and other related aspects. The funding agencies’ role, various types of research grants, the contents of the proposal, the formulation of proposal, ways of defending a research grant, and implementation of research grants were some of the topics covered during the workshop. Thirty Women faculty/researchers working at a State-level (public/private) Engineering/Technological Institutes or Universities from the states of Goa, Gujarat, Madhya Pradesh, Maharashtra and Rajasthan participated in this workshop.



Dignitaries Lighting the Lamp

During the opening session, Professor Sivaji Chakravorti, Vice-President, INAE and Professor, Electrical Engineering Department, Jadavpur University, Kolkata, emphasized the interconnectedness of teaching and research. He also highlighted the importance of encouraging women engineers to conduct research in order to bridge the gender gap. To do so, it is essential to secure funding. Prof. Atul Bhargav, IIT Gandhinagar and Prof. Amit Prashant, Dean R&D, IIT Gandhinagar also participated in the inauguration ceremony. Prof. Jhuma Saha, Assistant Professor, Electrical Engineering, IIT Gandhinagar gave some useful insights on grant writing. She emphasized the importance of grant writing for research projects. Her remarks were relevant to the researchers who are seeking funding for their projects, and it helped them to understand the intricacies involved in the grant writing process.



Workshop on “Writing R&D Grant Proposal for Women Engineers” Proceedings in Progress

Overall, the participation of eminent personalities in the workshop added value to the proceedings and provided deep understanding of the subject to the participants. Their presence and contribution helped to create a conducive learning atmosphere for the inauguration ceremony and demonstrated the importance of academia-industry collaboration for the growth and development of the manufacturing industry. As part of the event, a book called “Research Insights,” written by Dr. Rajiv K Tayal, formerly Adviser/Scientist ‘G’, of DST and a resource person for the workshop, was launched. Dr. RK Tayal gave a comprehensive talk on scientific Research and Development during the workshop. He began by discussing the classification of research and the importance of research in academics. He also emphasized the significance of good research and the qualities that define it. He then moved on to detail the essentials required for research, including funding options and extramural research grants and elaborated the different types of grants and their contents. He also covered the key elements that should be included in a grant proposal and provided insights on how to write a compelling proposal. Dr. Tayal also spoke about the rebuttal process, presentation, and discussion phases of a grant proposal. He highlighted the importance of making sense of the information and picking up leads during the research process. Overall, Dr. Tayal’s talk provided valuable insights an understanding into scientific research and development, and it was well-received by the workshop attendees. His expertise in the field added value to his talk which served as an excellent guide for those looking to pursue research.



Group Photograph of Participants with Dignitaries during Workshop on “Writing R&D Grant Proposal for Women Engineers”

During the one and a half-day workshop, Prof Sivaji Chakravorti and Dr. DR Prasada Raju delivered lectures on project-based learning and available funding opportunities, respectively. In addition to the technical sessions, the workshop also included several group activities aimed at building confidence among women engineers in crafting compelling R&D grant proposals for government agencies. An industrial visit was organized to Sahajanand Laser Technology Ltd during which the participants were provided with a detailed tour of the company's manufacturing unit, research and development facility, and quality control labs. Sahajanand Laser Technology Ltd is a renowned company that has been providing cutting-edge solutions for metal forming operations for more than three decades. The visit highlighted the importance of innovation and technology in the manufacturing industry, and how it can help to improve efficiency and productivity. Overall, it was a valuable learning experience for all the participants.



Highlights of the Workshop on “Writing R&D Grant Proposal for Women Engineers”

The distribution of mementos to all the speakers by Prof Atul Bhargav at the end of the workshop was a gesture of appreciation and recognition for their contribution to the workshop. It was a moment of gratitude and acknowledgement for the speakers who shared their knowledge and expertise with the participants. The workshop was an outstanding success in meeting the envisaged objectives.



Group Photographs during the Workshop on “Writing R&D Grant Proposal for Women Engineers”



c) SERB-INAE Outreach Programs for NE, J&K and Ladakh

(i) SERB-INAE 5-Day Workshop on “Innovation, Entrepreneurship and Start-Up for Young”

SERB-INAE sponsored 5-Day workshop (held in hybrid mode) on “Innovation, Entrepreneurship and Start-Up for Young” was organized by National Institute of Technology Mizoram from September 26-30, 2022. A total of 552 participants (512 online + 40 offline) had registered for the workshop from various institutions across the country. The institutions of the participants included NITs from all over the country including North East, Central Universities, State Universities and other affiliated colleges. The program started on 26th September 2022 with formal inaugural ceremony. Prof. Prof. Venkappayya R Desai, Civil Engineering, IIT Kharagpur participated in the ceremony and enlightened the participants about the importance of workshop. Dr. Debasis Chatterjee, Founder & CEO, Cnnfiscore.com was the Guest of Honour and shared his thoughts on the theme of the program. Prof. Saibal Chatterjee, Dean (Academics), NIT Mizoram and Coordinator of the workshop motivated the participants emphasizing the importance of the workshop and encouraged them to benefit from the proceedings of workshop. The detailed schedule (speakers and topics) of 5-Day workshop is as follows:

Day\Time Slot	10:00 – 11:00 hrs	11:00 – 12:00 hrs	12:00 – 13:00 hrs	13:00 – 14:00 hrs	14:00 – 15:00 hrs	15:00 – 16:00 hrs
Day 1 (26-09-2022)	Inauguration: Chief Guest: Prof. Venkappayya R Desai, IIT Kharagpur	Design Thinking for Innovation I Dr. Debasis Chatterji, Founder & CEO, Confiscore .com		LUNCH BREAK	Role of NABARD for Entrepreneurs & Start-Ups Mr. KVSSLV Prasada Rao, General Manager/OIC, NABARD Mizoram Regional Office.	
Day 2 (27-09-2022)	Design Thinking for Innovation II Dr. Debasis Chatterji, Founder & CEO, Confiscore.com 10-00 AM to 11-30 AM		IPR Prof. P. S. Robi IIT Guwahati 11-30 AM to 1-00 PM		Social Entrepreneurship Mr. Riddhinil Roy Serial Entrepreneur & Digital community evangelist Author, Founder at NE8x®	
Day 3 (28-09-2022)	Design Thinking for Innovation III Dr. Debasis Chatterji, Founder & CEO, Confiscore.com 10-15 AM to 11-45 AM		Design Thinking for Innovation IV Dr. Debasis Chatterji, Founder & CEO, Confiscore.com 12-00 noon to 1-30 PM		Brain Storming Session coordinated by Prof P S Robi and Dr. S. Chatterji 2-30 PM to 4-00 PM	Curriculum Design – Theory and Practical I Prof. S Sundar, Director, NIT Mizoram 4-00 PM to 5-00 PM
Day 4 (29-09-2022)			Entrepreneurship and Innovators in Northeast Dr. Laldinliana, Director, Mizoram University Incubation Centre 11-30 AM to 1-00 PM		IPR Laws I Mr. C. Lalfakzuala, Advocate, Gauhati High Court	

Day 5 (30-09-2022)	Curriculum Design – Theory and Practical II Prof. Sivaji Chakravorti, Vice President, INAE Professor, EED, Jadavpur University, Kolkata and Former Director, NIT Calicut 10-45 AM to 12-30 PM	IPR Laws II Mr. C. Lalfakzuala, Advocate, Gauhati High Court 12-30 PM to 1-30 PM	LUNCH BREAK	Curriculum Design – Theory and Practical III Prof. Sivaji Chakravorti, Vice President, INAE Professor, EED, Jadavpur University, Kolkata and Former Director, NIT Calicut 2-30 PM to 3-30 PM	Valedictory: Chief Guest: Prof. Sivaji Chakravorti, Vice President, INAE At 3-30 PM
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The participants had actively participated in all the sessions and interacted with the speakers. On the last day of the workshop, feedback was also collected from all the participants. The overall response was overwhelming. The week-long workshop on Innovation, Entrepreneurship and Start-Up for Young concluded with a formal valedictory function on 30th September 2022 afternoon. Prof. Sivaji Chakravorti, Vice-President, INAE was the Chief Guest and expressed his views on the importance of the workshop and key takeaways thereof. Various experts and the participants participated and expressed their opinion and feedback. The coordinators extended their invitation to all the participants to visit NIT Mizoram at their convenience and to work in joint collaborative activities.



Inaugural Session in Progress



Participants with Chief Guest of Valedictory Session



Group Photograph of Participants



Valedictory Session in Progress

(ii) Innovation Contest and Showcasing 2022

INAE and Science and Engineering Research Board (SERB) jointly organized the “Innovation Contest and Showcasing 2022” event in association with NIT Arunachal Pradesh from November 4-5, 2022, for the benefit of participants from all across the North Eastern Engineering Institutions, Universities and NITs. The objective of the event was to implement their knowledge in practice, and to set up start-up or develop a business model based on either product innovation or service innovation and to make it scalable, replicable and self-reliant in NE region. The event was inaugurated by Prof P Mahanta, Director, NIT Arunachal Pradesh. The objectives of the event was (a) to create a common interface for collaboration and showcase the best innovation and Start-up activities through exhibition from all Engineering Institutes, Universities and NITs across the North-East India, (b) to create an environment conducive to the development of local indigenous technologies and innovations, creating the scope and laying the foundation for the promotion of Translational Research and entrepreneurship and (c) to help the country achieve the goals of Start-up platform for academia and to showcase their expertise, products and technology innovations on mission mode. One hundred and twenty participants from all-over North-East region took part in the contest organised at NIT Arunachal Pradesh in offline mode. The host institute invited talks on Indian Innovation, start-up policy/challenges & opportunities and IPR by eminent dignitaries. In addition, Student competitions such as design thinking, poster presentations, brain storming sessions, debate sessions, essay competitions and quiz were held, and the winners were given prizes.



Participants from North-East Region



Certificate Distribution to the winners of Prizes

(iii) Workshop on Skill development for an idea to Prototype at NIT Nagaland under SERB-INAE Outreach Programs for NE, J&K and Ladakh was held on November 26-30, 2022 as a part of SERB-INAE Outreach Programs for NE, J&K and Ladakh. The objectives of the program were as follows: (i) To develop the skill to convert idea into a prototype, (ii) To develop the skill for market survey, (iii) To develop the skill for manufacturing and (iv) To develop the skill for marketing. Ninety-five participants registered for the workshop from NIT Nagaland, NIT Manipur, St. Joseph University and Nagaland University of Nagaland etc. The event comprised of five days rigorous sessions and training by eminent experts on Skill development for an idea to Prototype. The workshop focused on the students at the level of UG, PG and PhD from all NITs in North Eastern Region of India, and other Institutes/Colleges/Universities in the near vicinity. The primary objective of the event was to develop various skills such as to convert idea into a prototype, for market survey, for manufacturing and for marketing.



The workshop was inaugurated by Prof. Indranil Manna, President INAE, Chief Guest in the presence of Mr. Suparno Moitra, Founder & CEO, Indian Public Policy Foundation & Immediate, Former Chairman of the Board of Governors, NIT Nagaland and Mr. Taliwati Longchar, Director MSME as Guests of Honour. Prof. Manna addressed the gathering and gave a brief on activities of Indian National Academy of Engineering. He encouraged young minds to take up entrepreneurship and create start-ups which will further lead the country into a stronger economy. He briefed that INAE is an eminent body having 10 different domains with top most professional of the country divided in three categories such as (i) industry, (ii) academia, (iii) research organization. He apprised the students about Kalam Fellowship. He also addressed the gathering about the funding of SERB, DST to INAE for the benefit of the NE, J&K and Ladakh regions. The event continued for five days wherein fourteen experts from industry and academia delivered lectures on their expertise in entrepreneurship and start-ups and inspired the participants.

Prof. D. Viswanathan, Former Vice Chancellor, Anna University and Prof. Sivaji Chakravorti, Vice-President, INAE were present during the valedictory ceremony as the Chief Guest and Guest of Honour respectively. Prof. Sivaji Chakravorti addressed the gathering and inspired the students to be the part of design and manufacturing activities, such that our country could take a lead in both. He inspired the participants to go in for frugal innovation. He also emphasized on the importance of “Make in India” as this is the target of the Government. Then Prof. D. Viswanathan addressed the gathering by inspiring students towards entrepreneurship and start-ups. He also mentioned that the program is really a unique programme being conducted NIT Nagaland and sponsored by INAE. He also requested INAE to sponsor other such programmes in many other institutes to inspire young minds.



Students attending the Inauguration



Prof Indranil Manna, President, INAE, Chief Guest addressing the audience



Glimpses of Audience



Student Participation



Proceedings ongoing



Prof Indranil Manna, President, INAE Addressing the Audience



Group Photo of Participants in the Workshop



Student Participation



Prize Distribution



Prize Distribution



Prize Distribution



Prize Distribution



Group photograph of Participants with eminent speakers

(iv) Joint Workshop on “Science and Technology Exhibition” on February 1-2, 2023 at NIT Manipur

INAE and Science and Engineering Research Board (SERB) jointly organized a two-day “Science and Technology Exhibition” in association with National Institute of Technology, Manipur on February 1-2, 2023 under the aegis of the SERB-INAE Outreach Programs for NE, J&K and Ladakh. This workshop focused on prototype model display and discussion from students at the level of UG, PG and PhD from NITs in North Eastern Region of India and Institutes/Colleges/ Universities in Manipur State. The objectives of the event were (a) To Promote innovative ideas of the students in UG, PG and PhD (b) To encourage the students for developing the prototype models (c) To develop the scientific and technological knowledge of the participants.

The function was graced by Prof. Sivaji Chakravorti, Vice President of INAE as Chief Guest, Prof. S Venugopal Director, NIT Nagaland as the Guest of Honour, and Prof. Goutam Sutradhar, Director of NIT Manipur as the President of the inaugural function and delivered Presidential Address. A total of eighteen models or prototypes were presented by eighteen teams comprising 66 participants and 16 mentors in the diverse domains of Artificial Intelligence, Geographical Information System, Hydro-power, Environmental Impact Assessment etc. Various colleges or universities from Manipur, NIT Arunachal, and NIT Nagaland participated in the exhibition. The ideas and the models were focused on feasibility and market demand. The demonstrated ideas or models were highly appreciated by the dignitaries and the judges. The first and the second prizes were bagged by NIT Manipur and, Kamakhya Pemton College of Manipur won the third prize. Ten achievement prizes were awarded to the teams from various institutions participated for their innovative ideas.



Lamp lighting ceremony for “Science and Technology Exhibition” at NIT Manipur



Prof Sivaji Chakravorti, Chief Guest addressing the audience on the occasion of “Science and Technology Exhibition” at NIT Manipur



Group photograph of the prize winners for their innovative ideas at NIT Manipur

(d) SERB-INAE Hackathon 2022

The SERB-INAE Hackathon 2022 was organized jointly by SERB, INAE and Jadavpur University during September 3-4, 2022 at Jadavpur University, Kolkata. The event was supported by SERB and INAE. The objective of the event was to bring out the innovation and creative mindset amongst the undergraduate and postgraduate students from different engineering and science institutions of the country through their participation in this national-level, theme-based hackathon. This hackathon was a 30-hour non-stop event on four thematic areas and was housed in the School of Mobile Computing and IT Department in the SMCC Building of the Salt Lake Campus of Jadavpur University, which is located in a serene part of the city of Kolkata.

Participants were assigned cutting-edge problems related to four thematic areas:

- a) Artificial Intelligence and Machine Learning (AI/ML)
- b) Big Data Computation
- c) Cyber Security
- d) Data Driven Finance

The sessions in all four thematic areas ran in parallel in separate rooms. Each session was continuously monitored and mentored by a panel of jury and their associates. A call for participation document was widely circulated among academic institutions and research institutions. A webpage (<https://www.serb-inae-hackathon2022.com>) was specially designed for this purpose and an organizing committee was formed with members from academia, industry and INAE Fellowship. Students were asked to select one thematic area and prepare a brief concept note within 500 words. Students were further instructed to submit their proof of bona-fide studentship and registration details into the submission portal of website by filling up the registration form. Each participating team comprised of maximum upto three student members.

An initial deadline of 10th July 2022 was set for submission of the concept notes. Initially 50 submissions were received. Subsequently, as per the requests obtained from different participating teams, committee members felt the necessity of extension of submission dates. Subsequently, the submission date was extended to 8th August, 2022. An impressive figure of 99 concept notes was received by this deadline from a wide spectrum of engineering and science institutes. The distribution of entries was:

- e) AI ML: 74
- f) Big Data computation: 5
- g) Cyber security: 16
- h) Data Driven Finance: 4

Eminent faculty and industry professionals were invited to act as Jury members for the first round short-listing the candidates. The documents with the concept notes were distributed among the Jury members for short-listing of teams, who finally took part in the hackathon. The merit of the write-up was judged on the following basis: Innovativeness; Social relevance and Implementability. Accordingly, thirty-seven teams were shortlisted for the final round of physical participation in the hackathon in the four theme areas as detailed below:

- a) AI/ML :20 teams
- b) Big Data Computation :3 teams
- c) Cyber Security: 10 teams
- d) Data Driven Finance: 4 teams

The number of invited participants was 98. The following table provides a detailed account of their numbers and affiliations:

Institution-wise Participation

Institution	No of teams
IIT Jammu	1
Vidyasagar University, West Bengal	1
P S R Engg College, Tamil Nadu	1
Institute of Engineering and Management, Kolkata	1
JNTU Hyderabad	1
MNIT Jaipur	1
NIT Patna	1
Dayalbagh Educational Institute	1
Techno International University, Kolkata	1



IIT Guwahati	1
Jadavpur University	9
SVNIT, Gujrat	1
Chandigarh University	1
ISM Dhanbad	1
Amity University, Punjab	1
IIIT Naya Raipur	1
VIT Bhopal	2
B. V Raju Inst of Tech, Telangana	1
IIT Patna	1
AMITY University Noida	1
Swami Vivekananda University West Bengal	1
Sri Krishna College of Engg and Technology, Coimbatore	1
IIT Madras	1
Maulana Abul Kalam Azad University of Technology, West Bengal	1
VR Siddhartha Engg College	1
Sister Nivedita University, Kolkata	1
Sri Sri University, Odisha	1
J C Bose University of Sc. and Tech, Haryana	1

After finalization of teams, Jury members for the physical hackathon contest were assigned as per the thematic areas. Prof Samiran Chattopadhyay, Former Head, Department of Information Technology, Jadavpur University, acted as the Technical Coordinator for the event and coordinated with the jury members for problem statement formulation, adjudication process, technical content and related database management. Two problem statements per thematic areas were assigned to the teams. The teams took part to solve any one of the two given problems continuously for 30 hours.

Jury Members:

Sr. no.	Theme	Name of the Jury Member	Affiliation
1	AI/ ML	Dr. Alokesh Ghosh	CDAC Kolkata
2		Prof. Prasenjit Majumder	DA, IICT, Gandhinagar
3		Mr. Surupendu Prakash Gangopadhyay	DA, IICT, Gandhinagar

4	Cyber Security	Dr. John Jose	IIT Guwahati, CSE
5		Mr. Venugopal Ramamurthy	Qualcomm, Hyderabad
6	Data Driven Finance	Prof. Susmita Ghosh	JU, CSE
7		Prof. Jamuna Kanta Singh	JU, CSE
8	Big Data	Dr. Subhadeep Basu	JU, CSE
9		Prof. Snehanshu Saha	BITS, Goa
10		Mr. Vivek Karmakar	TheMathCompany

The jury members were assisted by a few associates, who had extensive R&D background as research scholars or postdoctoral fellows and were nominated by the jury members.

The problem statements were:

AI/ML:

Problem 1 - Automatically generate research highlights (RHS) given the abstract of a research paper.

Problem 2.1 - Binary Classification: Predict whether the close price of the next day will be in the upward or downward direction w.r.t to current day.

Problem 2.2 - Regression: Predict the share price of the next day based on historical information.

Big Data Computation:

Problem 1 - Publication data (DBLP) analysis

Problem 2 - Automated Surface Classification System using Vibration

Patterns Cyber Security:

Problem 1 - Application to manage access control to a defined set of applications based on user profile

Problem 2 - Application to determine the strength of password and also the ability to guess the user password

Data Driven Finance:

Problem 1 - Forecast minute-by-minute prices and volume (open-high-low-close- volume) of bitcoin trading.

Problem 2 - Determine whether a particular person would be a loan defaulter or not.



The registration process of the event was commenced on 3rd September 2022 morning. Subsequently, the inauguration of the event took place in the auditorium. Prof. Rajib Bandyopadhyay welcomed Prof. Sivaji Chakravorti, Vice President INAE and requested him to formally inaugurate the event and express his views on the ideation process. Subsequently, Prof. Samiran Chattopadhyay briefed the problem statements and the process flow instructions for the participants. The participants spent the entire night in the hackathon venue. Food, water, emergency medicines and other facilities of convenience were provided by the organizers in regular intervals. An army of 28 student volunteers and 12 faculty members were deployed to take care of the participants and ensure smooth functioning of the logistics.



Inauguration of the program



Students solving the problems

On 4th September 2022, after the completion of 30-hour hackathon, each team was given the opportunity of pitching their outcomes with results in front of jury members. At the end, score sheets were handed by the jury members over to Prof. Sivaji Chakravorti. Prof Indranil Manna, President INAE, and Prof Sandeep Verma, Secretary, SERB, and the Chief Guest of the program, joined virtually during the valedictory session, that was held in hybrid mode. Both Prof. Manna and Prof. Verma emphasized on the importance of introducing digital gaming initiatives to young students.

Prof Suranjan Das, Vice-Chancellor, Jadavpur University, highlighted that the hackathon provided a platform to solve problems pertaining to the themes, which encompassed new and emerging areas of science and engineering. Prof. Bhaskar Gupta, Dean Faculty of Engg. and Technology, Jadavpur University, highlighted the importance of such hackathon events to pave fast-technological advancement in recent years, and alluded to scenarios, where minds are controlled and communicated through machines. On behalf of the organizers, Prof. Sivaji Chakravorti and Prof. Rajib Bandyopadhyay felicitated all the jury members and INAE members. In the end, Prof. Sandeep Verma announced the names of the winners; a total of six Prizes were announced at the Hackathon in which Cash Prize of Rs 75,000 was announced to the winning team and Rs 50,000 to the runner-up.



Prof. Indranil Manna, Prof. Sandeep Verma
Prof. Sivaji Chakravorti and Prof. Bhaskar Gupta
addressing the audience during the Valedictory program



Photo session after the event

The final result of the Hackathon is shown in the table below:

Thematic Area	Name of the Participants, Institution
Artificial Intelligence and Machine Learning First Prize	Baban Gain, IIT, Patna
	Dibyanayan Bandyopadhyay, IIT, Patna
Artificial Intelligence and Machine Learning Second Prize	Sohel Aman Khan, Vidyasagar University
Cyber Security First Prize	Sumit Bhardwaj, J C Bose University of Science and Technology, Haryana
	Suhani Garg, J C Bose University of Science and Technology, Haryana
	Dinesh Yadav, J C Bose University of Science and Technology, Haryana
Cyber Security Second Prize	Mohit Raj, Vellore Institute of Technology, Bhopal
	Ashutosh Dubey, Vellore Institute of Technology, Bhopal
	Sayanth Fredaric Chalissery, Vellore Institute of Technology, Bhopal
Big Data Computation, Second Prize	Nikhilkumar Rajnikant Panchal, IIT Madras
	Abhijit Gajananrao Bhakte, IIT Madras
	Arunkumar M, IIT Madras
Data Driven Finance, Second Prize	Arka Choudhuri, Jadavpur University
	Anubhab Das, Jadavpur University



Academy Activities

Seminars/Workshops/Conferences –National

The Academy organizes Symposia/Seminars/Workshop/Conferences at national/international levels on topics of national importance. Based on the deliberations, INAE invariably brings out policy recommendations for suitable follow-up action by the concerned Ministry/Department/agency.

National Frontiers of Engineering (NatFoE 2022) & “Innovation in Manufacturing Practices (IMP)”

16th National Frontiers of Engineering (NatFoE) Symposium, 2022

The Symposium on National Frontiers of Engineering (NatFOE) is one of the flagship events of INAE since 2006. The main objective of the event is to encourage Young Engineers (ages ~27-45) from industry, universities, and R&D labs to discuss leading-edge research and technical work across a range of engineering fields. INAE organized the 16th National Frontiers of Engineering Symposium (NatFoE) jointly with Jadavpur University and in collaboration with IIT Kharagpur on 18th and 19th June 2022. This annual flagship event of INAE was organized at the Salt Lake campus of the Jadavpur University and was attended by young researchers across various academic institutions, R&D laboratories and industries as speakers and participants. It was a physical event organized after a long period of lockdown due to COVID pandemic and drew a huge enthusiasm from all quarters – participants, organizers and INAE Fellows and office bearers.

The inaugural program was presided over by the INAE President Prof. Indranil Manna. During the inaugural session, Prof. Sivaji Chakravorti, Vice President, INAE delivered the Welcome address and explained the objective of the symposium. He emphasized the critical role of the symposium in shaping the course of future research in cutting-edge engineering disciplines by bringing together young, talented and enterprising engineering professionals to deliberate on their research outcomes. Prof. Indranil Manna in his presidential address delved into the activities of INAE in forwarding the engineering education, research and knowledge transfer at various levels. He also enumerated how INAE contributes towards nation building by advancing expertise to various governmental and non-governmental organizations. Prof. Ashutosh Sharma, Chair Professor of IIT Kanpur and former Secretary Department of Science and Technology delivered the inaugural address of the symposium as the Chief Guest. He engrossed the audience with his inspiring speech covering a wide areas of research scope and elaborated the ways how the young researchers should carry forward research overcoming disciplinary barrier. He also stressed upon the presentation of the research results in addition to the quality of research. Pro Vice-Chancellor, Jadavpur University Prof. Chiranjib Bhattacharjee delivered a speech as the Guest of Honour. He elaborated the contribution of Jadavpur University towards education and research in the various Engineering disciplines. Prof. Amitava Datta, Coordinator of the Symposium moved the vote of thanks and expressed heartfelt gratitude to INAE for giving Jadavpur University an opportunity to organize the prestigious event. He also thanked everyone who helped in organizing the symposium.

There were four thematic areas in the symposium and a separate technical session was held in each of the thematic areas. The session of each thematic area was designed to have one plenary talk and four invited talks by experts from the relevant discipline. All the technical sessions were conducted by the respective theme

conveners. In addition, a special session on Azadi ka Amrit Mahotsav was organized to commemorate the seventy-fifth year of Indian independence and the achievements of the country during this period. The young participants attending the symposium also presented their research in a poster session separately organized for them. All the speakers and participants were chosen by the theme conveners, symposium coordinator and with guidance of Prof. Sivaji Chakravorti after critical review of their research activities. It was ensured that the participation was from across the entire country giving a national perspective to the symposium.

The first technical session was conducted by Prof. Ranjan Ganguly of Jadavpur University as the theme convener. The session began with a Plenary Lecture by Dr. Dhananjaya Dendukuri of Achira Labs Pvt. Ltd. In his talk titled “Rapid advances in point-of-care testing through microfluidic technologies, in a post COVID world,” Dr. Dendukuri discussed the market opportunities of microfluidics-enabled point-of-care testing (PoCT) and immunoassays and shared the experience of Achira Labs in translating the technology from Lab to Market through a few real-life examples. In the first invited lecture of the session, Dr. Pallab Sinha Mahapatra of IIT Madras deliberated upon a highly interesting topic titled “3D paper-based milk adulteration detection device” where he showed how capillary-driven flow through paper-substrates can be leveraged to detect the presence of milk adulteration. The next invited lecture was delivered by Dr. Pranab Kumar Mandal of IIT Guwahati, who spoke on a topic titled “Low-cost POC devices for detection of vitamin D-deficiency in blood.” Dr. Mandal described his research endeavour on the development of a paper-based miniaturized microfluidic biosensor that can detect the vitamin-D level in whole blood sample and diagnose its deficiency – a common health problem in a large section of Indian women population, especially those belonging to lower socio-economic groups. In the third lecture, titled “High-performance miniaturized physical sensors based on nano-composite materials and nanostructures,” Dr. Shrutidhara Sarma of IIT Jodhpur shared her pursuit with nanocomposite materials towards fabrication of a miniature physical sensor that can fit into a smart wearable architecture. The fourth and the last invited lecture was delivered by Dr. Dibyendu Das of IISER, Kolkata, who presented a futuristic paradigm of biosensing through his talk titled “Short Peptide-based Nanostructures as Micro-swimmers for Potential Biosensor Applications.” He deliberated on how nanomotor chassis, constructed from biological precursors and powered by biocatalytic transformations, can emulate the advanced traits of bacterial motility, and such transport can be deployed in microfluidic architecture to develop smart biosensors that will feature high sensitivity and specificity.

The thematic session on “Waste Valorization and Circular Economy” was chaired by theme convener Prof. Achintya Mukhopadhyay of Jadavpur University. In the plenary lecture of the session entitled “Biomass Gasification - Science, Technology and Applications”, Prof. M.R. Ravi of IIT Delhi briefly introduced the different types of gasifiers and discussed the science, technology and applications of gasification, highlighting how biomass gasification can be used as a potential solution to the environmental issues caused by stubble burning. Following it, in the first invited lecture entitled “Hydrothermal Liquefaction of Diverse Feedstocks for Sustainable Solid Waste Management and Energy Production in Indian Context”, Prof. R. Vinu from IIT Madras deliberated on generation of liquid biofuel from municipal solid waste, which in the Indian context, is largely unsegregated and heterogeneous. He also narrated the journey of an IIT Madras-based start-up that has come up as a consequence of their research. In the second invited talk entitled “Waste Valorization in a Circular Symbiotic Network”, Prof. Jayakrishna Kandasamy of Vellore Institute of Technology spoke on circular symbiotic network and sustainable manufacturing. He showed how the focus on areas like machine learning, Industrial IOT and design for disassembly highlights the importance of a multidisciplinary approach in this field. In the third invited talk entitled, “Circular Economy on Utilization of Waste Biomass in Pollution Control and Energy Generation”, Prof. Papita Das from Jadavpur University talked on circular bioeconomy as a convergence of circular economy and bioeconomy. She described the



research of her group on generation of bioethanol from peanut shell. In the last invited lecture of the session entitled “Green Biorefineries Towards Circular Economy: In Search of Healthy Alternatives”, Prof Amit Arora of IIT, Bombay brought up the issue of utilization of waste generated from food processing industry and food products and explained how it could alleviate the problem of a sustainable supply chain.

In the third thematic session titled “Resource-constrained Translational Technology” Prof. Rajib Bandyopadhyay of Jadavpur University chaired the session as convener. The plenary talk of the session was delivered by Dr Arpan Pal of TCS Research who presented a few examples on AI and IOT applications, where their research team has been working extensively for a few decades. Dr Pal then elaborated the challenges of resources, particularly in the context of edge computing, which are limiting the applications of big data computation for translational technologies. The first invited speaker Dr. Kumaravel S. of NIT Calicut elaborated the applications of different appliances used for power system and the challenges in this area. He mentioned about the wide gap between the researchers and the power industries to translate the novel concepts or solutions and mentioned some key points for minimizing this gap. The second invited speaker Dr Debangshu Dey of Jadavpur University presented the problems associated with the distribution of electrical power in our country and highlighted the need for condition-based monitoring systems instead of time-based systems. He concluded mentioning a few advanced signal processing techniques based on AI models and Rough Set theory for condition-based monitoring systems of high voltage electrical appliances. Dr Sri Krishna Kumar of IIT Kharagpur highlighted the need for real-time decision making and elaborated the financial implications for appropriate real-time decision making in supply chain management in the manufacturing sector. He also mentioned the role of IOT in the manufacturing industries and how it can be utilized towards implementation of Industry 4.0. The last invited speaker of this session was from Dr. Chirasree Roy Chaudhuri of IIST Shibpur. She explained the diagnostic technologies using various types of biosensors with emphasis on the resource constraints due to small sample volume and highlighted the uses of FET biosensor, graphene and zinc oxide nanorod based sensors.

The fourth thematic session in the symposium on “Nanostructured Surfaces for Functional Materials and Systems” was conducted by Prof. Samit K. Ray of IIT Kharagpur as the theme convener. The session covered lectures on nanomaterials-based surface engineering, nano-sensors and materials for energy harvesting with one Plenary and three Invited lectures. The Plenary lecture on “Liquid Infused Slippery Surfaces: From Fabrication to Functionalities” was delivered by Prof. Suman Chakraborty, IIT, Kharagpur. The plenary speaker reviewed some fundamental scientific and technological aspects concerning the stabilization dynamics of liquid infused slippery interfaces (LISS), which yield self-healing and long-lasting surface finish in engineering materials. By harnessing rose-petal mimicking microstructures, the speaker illustrated several examples on controlling the surfaces, which contain self-propelling features of soft moieties having emerging applications in energy harvesting and medical diagnostics. The first invited talk was delivered by Dr. Ritesh Kumar, CSIR-Central Scientific Instrumentation Organization, Chandigarh on “Understanding Olfactory Spaces: A Journey from Molecule to Machine learning and instrumentation”. Dr. Kumar discussed the odour source localization technique extensively in biology, organic chemicals and food products and demonstrated the efficacy of machine learning technique for odour and smell sensing. Finally, he highlighted his work on the development of Electronic Nose and Tongue systems. The second invited talk was delivered on “Functionalized Graphitic Carbon Nitride (g-C₃N₄) Nanosheets for Flexible and Wearable Triboelectric Nanogenerators” by Dr. Sayan Bayan from Rajiv Gandhi University, Arunachal Pradesh. Dr. Bayan discussed the mechanism of Triboelectric Nanogenerators (TENGs) for mechanical energy harvesting through appropriate surface functionalization of graphitic carbon nitride nanosheets. The third invited lecture was delivered by Dr. Gururaj Telasang, ARCI, Hyderabad. Dr. Gururaj described the use of Plasma and Laser Surface Texturing and coatings to prepare multifunctional surfaces with emerging applications in engineering products. The presentation included the use of hierarchical micro-nanostructures

using femtosecond laser pulses to improve the machinability of tool inserts by reducing diffusion wear; creation of microchannels on cyclic olefin polymer films for the microfluidic field etc.

The special session of Azadi ka Amrit Mahotsav had four very distinguished keynote speakers from different fields of engineering science and technology. The first talk of the session was delivered by Prof. Samir Kumar Pal of S.N. Bose Centre for Basic Sciences, who introduced the potential of nano-medicine to cure many fatal diseases. He demonstrated how the spectroscopic analysis can be used to develop advanced medical diagnostic tools and emphasized the importance of interfacial dynamics of nanocomposites in medical diagnostics. In the second lecture of the session, Prof. Avinash Kumar Agarwal of IIT Kanpur talked about the methanol economy under the Indian perspective. He discussed the potential of methanol as a transportation fuel along with its technical and economic viabilities. The opportunities and challenges of methanol as a fuel and the gap areas in the translation to the commercial use were discussed. In the third lecture, Prof. Mahati Chittem of IIT Hyderabad dealt with the social science approach to the medical technology analysing the behaviour of the people through personal interactions with stakeholders, like doctors, nurses, technicians and of course patients. Study results were presented on the difficulties in performing peripheral vein intrusion to reach at important conclusions which can bring relief to the patients. Finally, in the last lecture of the session, Mr. K. Rashid of Genrobotics Innovation, a start-up company from Kerala, explained their work in eliminating manual scavenging by sanitation workers leading to upliftment of the society and helping to overcome fatal diseases.

A plenary talk was delivered by Prof. P.P. Chakrabarti, former Director, IIT Kharagpur, in a special session on 18th June 2022 evening. Prof. Chakrabarti enthralled the audience with an overview of Artificial Intelligence and Machine Learning and portrayed the future perspectives of the subject. All the talks of every session led to engaging discussions following the presentations and also beyond the session during the symposium. Strong synergistic areas were identified by the speakers and other participants in these domains, and engaging research collaborations are expected as a future outgrowth. During the valedictory session, the theme conveners summarized the outcome of the sessions of their respective theme areas and the participants expressed their opinions on the symposium. All the participants spoke highly about the organization of the symposium and stated that the peer interactions and discussions held during the symposium will help them in their future research. Participation certificates were distributed during the valedictory sessions by Prof. Purnendu Ghosh and Prof. Sivaji Chakravorti, Vice Presidents of INAE.



Group Photograph of NatFoE Symposium on Day -1



Inaugural program of NatFoE 2022



Prof Indranil Manna delivering Presidential Address

An Abstract Booklet of NatFoE 2022 was released during the event.



Inaugural Session in Progress



Prof Indranil Manna addressing the Audience



Prof Ashutosh Sharma delivering Inaugural Address



Prof Sivaji Chakravorti in Poster Session



Poster Session

Innovations in Manufacturing Practices (IMP) 2022

Changes in present day manufacturing reflect advancements in supply chain, markets, customer demands and engineering design. Growth of manufacturing sector of our country can significantly boost the national economy. Keeping this in mind, INAE and Jadavpur University, Kolkata organized a National Competition on Innovation in Manufacturing Practices (IMP 2022) at Jadavpur University, Kolkata on 20th June 2022 subsequent to the National Frontiers of Engineering Symposium 2022 to provide a platform for engineering students and startups to showcase innovations in manufacturing sector. After two years of pandemic, the event was organized in physical mode.

Participation was solicited in three categories – Undergraduate Students, Postgraduate Students and Startups. Total 55 innovations were submitted (22 in UG, 16 in PG and 6 in Startup categories) from different corners of our country. It was a two-round contest. The submitted entries were evaluated in the first round on the basis of their presentation video and submitted write-up. A jury board was constituted of three members, of whom two were INAE Young Engineer awardees and one was INAE Woman Engineer awardee. The jury board selected total 18 entries (six from each category) in the first round for final physical presentation on 20th June 2022. The final event was organized at UGC-HRDC Lecture Hall of Jadavpur University, Salt Lake Campus, Kolkata.

The event was inaugurated by Prof. Purnendu Ghosh, Vice President, INAE, and the participants were welcomed by Prof. Sivaji Chakravorti, Vice President, INAE. The Inaugural session was followed by three consecutive sessions for three categories. These sessions were chaired by three eminent academicians in the field of engineering & technology. However, the final event was attended by 12 participants (5 in UG, 4 in PG and 3 in Start-up categories) out of the selected 18 participating teams, mainly due to the sudden disruption in logistic services.

As the contest is prestigious, it was decided that only the deserving innovations will be awarded, and this was declared in the inaugural session. The jury members accordingly applied their judgment for conferment of the prizes. Finally, the jury board did not recommend any entry for the award in PG and Start-up categories. The first and the second prizes in the UG category went to two girl participants for their appreciable innovations. The awards were announced by Prof. Sivaji Chakravorti in the Valedictory Session of the event, after distribution of the participation certificates to the participants.

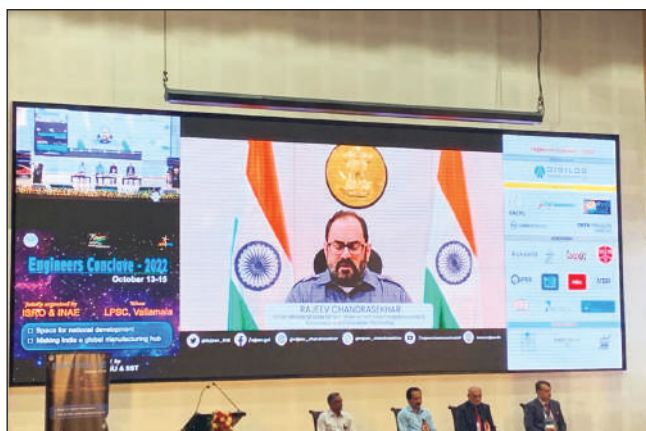


Prof. Sivaji Chakravorti, Prof. Amitava Datta and Prof. Swarnendu Sen
with the two award winners in UG category

Engineers Conclave 2022

The Ninth Engineers Conclave-2022 (EC-2022) of the Indian National Academy of Engineering was held jointly with Indian Space Research Organization (ISRO) on October 13-15, 2022 at Liquid Propulsion Systems Centre (LPSC-ISRO), Thiruvananthapuram. The two themes for Engineers Conclave-2022 (EC-2022) were: Theme I on “Space for National Development” coordinated by ISRO, and Theme II on “Transforming India into a Global Manufacturing Hub” coordinated by INAE. The Inaugural Session was graced by Shri S Somanath, Chairman, ISRO and Chairperson EC-2022; Prof Indranil Manna, President, INAE; Dr V Narayanan, Director, LPSC and Lt Col Shobhit Rai (Retd), Deputy Executive Director, INAE. The event commenced with the Invocation. In his Welcome Address, Dr V Narayanan elucidated the importance of the two themes for the conclave. He opined that it was envisaged that the plenary talks, lectures and deliberations shall result in identifying national requirements and shall emanate to actionable recommendations towards implementation of the two themes.

Prof Indranil Manna, President, INAE in his presidential address emphasized that INAE is a conglomeration of eminent engineers dedicated to contributing to national development through engineering innovations and gave an overview of opportunities for Indian manufacturing sector and its role in the vision of Atmanirbhar Bharat. Shri Rajeev Chandrasekhar, Hon’ble Minister of State for Electronics and Information Technology and Skill Development, the Chief Guest of the Function delivered the Inaugural Address in video mode. He highlighted that it is expected that there will be a paradigm shift in the next decade when India will switch roles from being a consumer of technologies, to be an architect and designer in developing devises, products, platforms and solutions. Shri S Somanath, delivered the Keynote Address on “Future Perspective of Space Ecosystem” wherein he expressed that the space enterprise must be people centric and application driven. He emphasized that ISRO is currently in its expansion phase, looking forward to innovative missions, new services and global outreach. He also touched upon the major role that INAE is playing in such useful initiatives. Lighting of the lamp was carried out by the dignitaries. The Abstract Booklet of Engineers Conclave 2022 was released during the Inaugural Session which concluded with the Vote of Thanks proposed by Lt Col Shobhit Rai (Retd).



Shri Rajeev Chandrasekhar, Hon'ble Minister of State for Electronics and Information Technology and Skill Development delivering Inaugural Address



Prof Indranil Manna delivering Presidential Address



Lighting of Lamp by Dignitaries



Release of Abstract Booklet

Following the Inaugural function, an exhibition of engineering products was inaugurated by Dr S Unnikrishnan Nair, Director, VSSC/IIST and Dr Sam Dayala Dev D, Director IISU. A luncheon Meeting on “Making India Global Manufacturing Hub” was held with selected dignitaries as invitees. This was followed by two parallel sessions on Two Themes which continued on October 14, 2022 (Day 2 of the conclave). The deliberation on the two themes focused on cutting edge solutions to arrive at specific recommendations. The recording of the Inaugural Session of Engineers Conclave 2022 can be viewed by clicking on the link <https://www.youtube.com/watch?v=k7wOIDJIbFc>

Six enlightening Plenary Talks were delivered during the Engineers Conclave 2022, the first on “Making Manufacturing the next frontier for India’s global leadership- Auto Industry” by Mr Girish Wagh, Executive Director, Tata Motors; the second on “Blue Economy Development” by Dr. Shailesh Nayak, Former Secretary, Ministry of Earth Science; the third on “Space for Earth Science” by Dr. Srinivasa Kumar, Director, INCOIS; the fourth Plenary on “Emerging Scientific Missions by Dr Anil Bharadwaj, Director, Physical Research Laboratory; the fifth on “India as an Emerging World Power-Challenges and Opportunities” by Shri G. Mohan Kumar, IAS (Retd), Former Defence Secretary, Govt of India and the sixth on Challenges in Human Space Mission by Dr S Unnikrishnan Nair, Director, VSSC .



On Day 3- October 15, 2022 two Parallel Sessions were held on the two themes viz Theme 1 on “Space for National Development” chaired by Theme 1 Coordinator- Dr Prakash Chauhan, Director, NRSC and Theme 2 on “Transforming India into a Global Manufacturing Hub” chaired by Theme 2 Coordinator- Shri. A.T. Ramchandani, FNAE, Executive Vice-President & Head-Defence IC, L&T during which the recommendations were finalized based on the panel discussion. Theme 1 focused on how India has the potential to be the space hub of the world and some of the recommendations include working on new technologies, expansion of space sector and reduction of production time. Also, opening of new private players and financial institutions in the space sector to transform knowledge and technologies into a business model. Theme 2 focused on Policy interventions for manufacturing including Simplification of processes; Production linked incentives and Enabling of Fiscal policies and MSME. Some key recommendations are advancement of education sector to cope up with the demands of the market and giving problem solving skills paramount importance in order to adhere to market demands.

The conclave concluded with the Valedictory Session in the afternoon of October 15, 2022 wherein the Introductory Remarks were delivered by Prof Indranil Manna, President, INAE followed by Summing up of Technical Sessions of two Themes by the respective Theme Coordinators. The highlights of the Session were the Address by Shri S Somanath, Chairman, EC-2022 and Valedictory Address by Dr Vijay Kumar Saraswat, FNAE, Member, NITI Aayog & Chancellor, Jawaharlal Nehru University. Dr VK Saraswat in his address brought out that the thrust of the nation was in creating an eco-system for S&T development by setting up world class institutions like CSIR Labs, DRDO, ISRO, IITs. Also, a push was given for progress of steel, energy, textiles, pharmaceuticals, defence and consumer goods industries in public and private sectors. All this has brought India into the league of developing nation with its GDP growing every year at 6-8%. He mentioned that the world is looking at us with hope to invest.



Valedictory Session



Felicitation of Dr. VK Saraswat, FNAE

About 400 eminent experts and senior functionaries from National and State Centres/ Departments/ Units, Academia, R&D, Industry and INAE participated in the conclave and the event was an astounding success. Actionable recommendations emanating from the deliberations were compiled and followed up with the concerned Government Departments/Agencies for consideration. The event was meaningful in achieving the laid down objectives.



Seminars/Workshops/Conferences – International

5th INAE-NAEK Workshop on Advanced Materials for Sustainable Development on Aug 25-26, 2022

Indian National Academy of Engineering (INAE), the only engineering Academy in the country represents India at the International Council of Academies of Engineering and Technological Sciences (CAETS). CAETS is an independent non-political, non-governmental, international organization of engineering and technological sciences academies, one-member Academy per country. INAE conducts various joint Workshops with Member Academies of CAETS. One such collaborative workshop between INAE and NAEK has been undergoing since 2017. This year 5th INAE-NAEK Workshop on “Advanced Materials for Sustainable Development” was held on August 25-26, 2022 at Kolkata in hybrid mode. The two themes of the workshop were “Materials for Quantum Computing” and “Machine Learning for development of Advanced Materials”. The Indian and the Korean groups of scientists assembled in two local cities- Kolkata in India and Seoul in Korea. To adjust the time zones between the two cities, there was a need to restrict the technical discussions within limited hours and as such within a limited number of technical sessions.

Over the course of two days, updates on R&D activities relating to advanced materials, especially those activities associated with Quantum Computing and Machine Learning were highlighted. This workshop provided a platform for future collaboration between researchers from both countries and also served as an important venue for vigorous exchanges and collaborations between Korean and Indian engineers. Sixteen experts representing Korea and India in the field of Materials for Quantum Computing and Machine Learning for Development of Advanced Materials sessions delivered the technical Presentations.

On 25 August 2022, the event started with the Inauguration session. Prof Sanghamitra Bandyopadhyay, Director, Indian Statistical Institute, Kolkata and Prof Debatosh Guha, FNAE & Professor, Institute of Radio Physics and Electronics, University of Calcutta delivered the Introductory Remarks. Subsequently, Prof Indranil Manna, President, INAE delivered the Welcome Address. During his Address, he gave a brief about INAE activities. He highlighted that India is pursuing the path of development and in words of Our Hon’ble Prime Minister, a goal of Atmanirbhar Bharat or Self-reliant India. In this path of development engineering and technology plays a vital role. We need a peer body like INAE to steer this initiative. Subsequently, Prof Jung-Hee Song, Vice-President, NAEK delivered her Welcome Address. In her Address, she highlighted the possibility of convergence between materials science and ICT under the theme of “Advanced Materials for Sustainable Development”. The aim of this workshop was to provide and establish science and technology policy guidelines by examining major issues and technological development in the ICT and materials industries.

The theme of discussions on Day 1 was ‘Materials for Quantum Computing’ which was designed through two technical sessions. Those sessions were chaired by Samit Kumar Ray, Professor, Department of Physics, IIT Kharagpur, India and Seung-Cheol Lee, Director of Indo-Korea Science & Technology Center, KIST, South Korea. Session I contained four keynote talks:

How to make a Quantum computer?

Amlan Mukherjee, QpiAI India Pvt. Ltd, Bengaluru, India

Recent advances in semiconductor quantum dot-based quantum computing

Dohun Kim, Dept. of Physics & Astronomy, Seoul National University



Engineering Spin-Orbit Interaction for Qubit Technologies

Bhaskaran Muralidharan, Dept. of Electrical Engg., IIT Bombay, India

Quantum computing applications: Quantum algorithm optimization

Doyeol (David) Ahn, Dept. of ECE, University of Seoul, Korea & Co-founder and CTO, First Quantum Inc.



Lectures by various eminent experts during the technical sessions

Two technical sessions pertaining to the theme “Materials for Quantum Computing” chaired by Prof Samit Kumar Ray, Professor, Department of Physics, IIT Kharagpur, India and Dr Seung-Cheol Lee, Director of Indo-Korea Science & Technology Center, KIST, South Korea were held. On 26 August 2022, two technical sessions pertaining to the theme “Machine Learning for development of Advanced Materials” which were chaired by Prof Sanghamitra Bandyopadhyay, Director, Indian Statistical Institute, Kolkata, India and Prof Tae-yeon Seong, Professor, Korea University were held.



Welcome Address by
Prof Indranil Manna, President, INAE



Prof Jung-Hee Song, Vice-President,
NAEK, Korea delivering Welcome Address

The majority of the presentations were made in physical mode except only a very few special cases where the speakers were on overseas travel. Session II comprised four more keynote talks:

Silicon Quantum Information Technology

Samaresh Das, Centre for Applied Research in Electronics, IIT Delhi, India

L0D, 1D, 2D and 3D materials prepared in KIST for the quantum information technology

Jindong Song, Center for Opto-Electronic Convergence Systems, KIST

Light-matter interactions in 2D materials for Quantum Photonic Devices

Samit Kumar Ray, Department of Physics, IIT Kharagpur, India

A Chemistry Application of Quantum Krylov Subspace Diagonalization aided by Quantum Power Method

Joonsuk Huh, Institute of Quantum Biophysics, Sungkyunkwan University, South Korea

Each talk culminated with very lively question answer session. The participants from both countries took part in that discussion indicating common interests and possibility of developing collaborative research programs.

Technical sessions III and IV were planned for Day 2 focusing on ‘**Machine Learning for development of Advanced Materials**’. Both sessions were chaired by Sanghamitra Bandyopadhyay, Director, Indian Statistical Institute, Kolkata, India and Tae-yeon Seong, Professor, Korea University. Each of the sessions comprised four keynote talks as follows:



Session III

Predictive Models of Materials based on Quantum Physics and Machine Learning

Umesh V. Waghmare, Theoretical Sciences Unit, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru, India

Machine-Enabled Chemical Structure-Property-Synthesizability Predictions

Yousung Jung, Dept. of Chemical & Biomolecular Engineering, KAIST

Machine Learning Approach of Design of New Materials with Targeted Properties

Tanusri Saha-Dasgupta, S. N. Bose National Centre for Basic Sciences, Kolkata, India

Machine learning potentials enabling realistic material simulation and accelerated material discovery

Seungwu Han, Materials Science and Engineering, Seoul National University, Korea



Prof Sanghamitra Bandyopadhyay, Director, Indian Statistical Institute
Kolkata chairing technical session during the Workshop

Session IV

Application of machine learning and neural network to predict materials properties and design a new material

Seung-Cheol Lee, Indo-Korea Science & Technology Center, KIST

Machine Learning assisted hierarchical filtering to identify novel magnetic materials

Prasenjit Sen, Harish-Chandra Research Institute, Prayagraj, India

Data-driven design for high-performance SnSe-based thermoelectric material

Hyunju Chang, Chemical Platform Technology Division, KRICT

Machine learning assisted workflows for the discovery of low dimensional/quantum materials

Nawaf Alampara, QpiAI India Pvt. Ltd, Bengaluru, India

A nice blend of Industry, R&D Laboratories, and academia was successfully planned by both Academies. The concluding session indeed became vibrant and interactive. Several thoughts and suggestions were discussed indicating a fruitful outcome in terms of future planning, proposal, and strengthening collaborative research between these two countries.



Prof Debatosh Guha addressing the gathering

In conclusion, Prof. Indranil Manna expressed his happiness for having such a successful meeting and congratulated the team members of both Academies. The Vote of Thanks was proposed by Lt Col Shobhit Rai (Retd), Deputy Executive Director, INAE. The event ended with the Concluding Session during which discussion and finalization of statement for future scope of collaboration were held. The workshop was attended physically by 50 participants and online by various participants. This workshop was an outstanding success. The event was also streamed Live on Youtube. The links are as under.

25th August 2022- <https://www.youtube.com/watch?v=YxY13tYAqwQ&t=1239s>

26th August 2022- <https://www.youtube.com/watch?v=Eo9HbTa4KRM>



Prof Sanghamitra Bandyopadhyay,
Director, ISI, Kolkata
delivering Introductory Address



Vote of Thanks proposed by
Lt Col Shobhit Rai (Retd),
Deputy Executive Director, INAE



Indian Participants at the workshop
at Kolkata



Other Activities/Affairs of INAE

INAE Foundation Day Celebrations 2022

Indian National Academy of Engineering (INAE) celebrates its Foundation Day on 20th April each year and this year, INAE Headquarters organized two unique events on 20th April 2022 as given below.

(i) **INAE Foundation Day Function** was held in the afternoon wherein the Chief Guest was Dr. PS Goel, Former President, INAE and Chairperson, National Innovation Foundation-India who delivered an address on “INAE’s Future Direction”. The Presidential Address was delivered by Prof Indranil Manna and briefing on activities in last one year, by the three Vice-Presidents of INAE.



Left to right: Dr PS Goel, Former President, INAE and Prof Indranil Manna, President, INAE



Group Photo of INAE Foundation Day Function with INAE Office Bearers, Fellows and Staff

(ii) **Distinguished Panel Discussion on “Opportunities and Challenges of Implementation of National Education Policy (NEP) 2020 for Engineering Disciplines and Profession”** chaired by Dr K Kasturirangan, Former Secretary, Department of Space; Former President of INAE & Chairman NEP 2020 Drafting Committee was held on April 20, 2022 evening. Experts deliberated on opportunities and challenges of implementation of National Education Policy (NEP) 2020 for engineering disciplines and profession at a panel discussion organised on the occasion of the Foundation Day celebration of the Indian National Academy of Engineering (INAE) on April 20, 2022. The discussion topic was chosen on NEP 2020 since the principal author of the NEP 2020 was Dr K Kasturirangan, former President, INAE and the INAE Fellowship having representation from leading academicians, researchers and industry experts are well suited to share their vast experience and give real-time feedback on NEP 2020 and suggest valuable ideas for its effective implementation, which is vital for the growth of education and in particular engineering education in the country.

The panel discussion was chaired by Dr K Kasturirangan, Former Secretary, Department of Space; Former President of INAE & Chairman NEP 2020 Drafting Committee. Dr K Kasturirangan highlighted the role that INAE can play in implementing NEP 2020 which could be truly reflective of highest of intellectual inputs and help formulate a roadmap for implementation. He further brought out that though NEP covers the entire spectrum of education right from school education to University level, the issues related to

engineering education and its focus in the implementation of NEP in all engineering colleges and institutions in the country were of paramount importance and the subject of the initiative.

The celebrations also included five satellite events steered by the present or former Directors of IIT Kharagpur, IIT Delhi, IIT Bombay, IISc Bangalore and IIT Hyderabad. While Prof PP Chakrabarti, Former Director, IIT Kharagpur elaborated on academic aspects, Prof V Ramgopal Rao, Former Director, IIT Delhi spoke on the accreditation and higher education; Prof Subhasis Chaudhuri, Director, IIT Bombay focused on administrative aspects applicable to technical institutions. Prof Anurag Kumar, Former Director, Indian Institute of Science, Bangalore spoke on R&D and industrial sector and Prof BS Murty, Director, IIT Hyderabad focused on teaching. The satellite events comprised of online discussion meetings covering various aspects of engineering education pertaining to NEP and the Panelists comprised of leading academicians and industry experts including lady representatives in leadership roles who deliberated on the chosen topics and formulated actionable recommendations.

The respective Convener of these five satellite events presented these recommendations before the subject Panel on April 20, 2022. The overarching objective of this entire exercise was to formulate actionable recommendations on the theme for the successful implementation of NEP 2020 in realistic stages and timeline through the concerned stakeholders in the Government Agencies, Academic Institutions, Industry and R&D Organizations. Some of the important recommendations included that Autonomy must go hand in hand with accountability; Internationalization is absolutely essential from the point of building cultural diversity on our campuses; need for high quality teaching faculty and to invest in physical infrastructure to enable the teaching to be more hands on and upgrade them periodically; Atmanirbhar initiatives should be technology driven; expansion of Accessibility of Resource Base; need for Next-Generation Faculty Development; National Research Foundation will need to enhance the current research funding ecosystem; emphasis on the Government-Universities-Industry linkages in research and measures to make engineering education more inclusive and encourage diversity. These recommendations were followed up with the concerned Government departments as they would help in the widespread implementation of NEP across the nation.

The session was moderated by Professor Indranil Manna, President, INAE and Vice-Chancellor, BIT, Mesra and Professor Sivaji Chakravorti, Vice-President, INAE and Professor, Electrical Engg Department, Jadavpur University, Kolkata and former Director, NIT Calicut. Prof Indranil Manna mentioned that the Apex Committee, the think tank of INAE has envisaged this event and had planned the event to make it meaningful and achieve the objectives of implementation of NEP in the country by deliberating on all relevant opportunities and challenges. Prof Sivaji Chakravorti re-iterated that he had participated in all the five satellite events and the outcome of deliberations covering a spectrum of aspects related to NEP 2020 and its implementation in engineering colleges/institutions in the country were pertinent and the same would be compiled and forwarded to the concerned Government departments/agencies for necessary follow up actions to take this initiative to its logical conclusion.

Subsequent to the presentations by the five Conveners during the Distinguished Panel Discussion, views on the subject were invited from the invited Panelists who included Prof. M Jagadesh Kumar, Chairman, UGC; Prof Anil D. Sahasrabudhe, Chairman, AICTE; Prof. Sandeep Verma, Secretary SERB; Dr. Ananya Mukherjee, Vice-Chancellor, Shiv Nadar University; Vice-Chancellor, Dr. S. Vaidhyasubramaniam, Sastra University, Thanjavur; Dr Debashish Bhattacharjee, VP Technology & New Materials Business, Tata Steel Ltd. & Rep CII; Senior Industry Fellows viz Mr Senapathy Kris Gopalakrishnan, Co-founder Infosys & Chairman Axilor Ventures and Mr. MV Kotwal, Formerly Member of the L&T Board & President Heavy



Left to Right: Dr K Kasturirangan, Chair and Prof Indranil Manna, President, INAE

Engineering ; Dr. PS Goel, former President of INAE; Prof Purnendu Ghosh, Prof AB Pandit, and Prof Sivaji Chakravorti- Vice-Presidents of INAE; Dr DK Sharma, Rep of Secretary, Higher Education, Government of India and other distinguished invitees. Prof Indranil Manna, President, INAE responded to the suggestions and the final comments were delivered by Dr K Kasturirangan, Chair of the event who expressed that this initiative of INAE is unique and will have a great impact in the implementation of NEP 2020 through formulation of pertinent actionable recommendations. A comprehensive set of steps which are required to be taken were enumerated in the report which emerged out of this discussion and set the tone for further deliberations which were followed up with concerned Government Departments/stakeholders for furtherance of the initiative.



Group Photo of Panelists: from Left to Right

Sitting: Prof Anil D. Sahasrabudhe, Dr PS Goel, Prof. M Jagadesh Kumar, Dr K Kasturirangan, Mr Senapathy Kris Gopalakrishnan, Dr. Ananya Mukherjee and Mr. MV Kotwal

Standing: Prof PP Chakrabarti, Prof. Sandeep Verma, Prof Sivaji Chakravorti, Prof Indranil Manna, Dr. S. Vaidhyasubramaniam, Prof Purnendu Ghosh and Dr Debashish Bhattacharjee

Engineers Day Celebrations - Distinguished lecture on 'Towards Atmanirbhar Bharat - Role of Engineers'

The Indian National Academy of Engineering (INAE) organised an online event to commemorate Engineers' Day celebrations on 15th September 2022, wherein Dr G Satheesh Reddy, FNAE, Scientific Advisor to Raksha Mantri, Ministry of Defence, Govt. of India, delivered a distinguished lecture on "Towards Atmanirbhar Bharat - Role of Engineers". The event started with address of Prof Indranil Manna, President, INAE wherein he gave a brief about one of the country's greatest engineer, Sir Mokshagundam Visvesvaraya. He then introduced Dr G Satheesh Reddy and invited him to address the participants.

At the commencement of his talk, Dr G Satheesh Reddy highlighted the importance of engineering in the prosperity of the nation, its role in social needs and in achieving the goal of Atmanirbhar Bharat- the vision of the Hon'ble Prime Minister. He stressed on the need of India becoming an economically powerful and prosperous country a strong academia and working with the mandate of 'Make in India to Make for the World'. He emphasized the need of India becoming more self-reliant in the fields of communication, Computer Applications, Defence Production, strategic materials and manufacturing and moving forward in the field of Artificial Intelligence and Machine Learning. He highlighted that currently India is home to as many as 75,000 start-ups by its youth primarily in the fields of engineering and technology. The event concluded after Question and Answers session. It was attended virtually by a large number of participants, INAE Fellows and dignitaries, to make it a successful event. Prof Indranil Manna, President, INAE thanked all the participants for attending this event. For the perusal of all interested, the recording of the event was uploaded on the INAE website. The link is as under.

- https://www.youtube.com/watch?v=KkFpKLT_65Q



Address by Prof Indranil Manna, President, INAE



Talk by Dr G Satheesh Reddy, FNAE,
Scientific Advisor to Raksha Mantri,
Ministry of Defence, Govt. of India

INAE's Participation in India International Trade Fair 2022 at Pragati Maidan, New Delhi

INAE participated in the India International Trade Fair (IITF 2022) held at Pragati Maidan, New Delhi during November 14-27, 2022 under the aegis of Department of Science and Technology (DST), Government of India. The Pavilion of DST at Hall 7D- Open area housed seven of its Autonomous Institutes namely Indian National Academy of Engineering (INAE) : Aryabhata Research Institute of Observational Sciences, (AIRIES) Nainital; Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum ; Survey



of India (SOI), Technology Development Board (TDB); North East Centre for Technology Application and Reach (NECTAR) and National Innovation Foundation (NIF). The pavilion of DST had several new technologies at display and was a platform for the dissemination of information on various new initiatives. INAE representatives present during the period had an informative experience while interacting with general public explaining about the INAE its Mission, Vision, objectives and various initiatives undertaken by INAE. This participation also provided opportunity to various Autonomous Institutes under DST to know about each other's working and mandate.



INAE Staff with dignitaries during the event

INAE Youth Activities

INAE Youth Conclave 2022 on Technology Self- Reliance

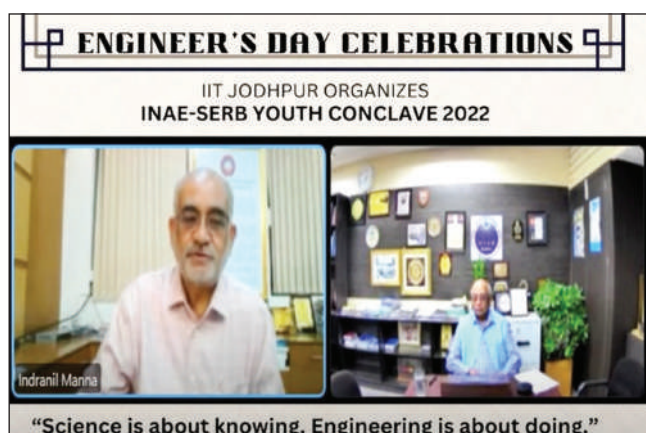
INAE organized the Youth Conclave 2022 in collaboration with IIT Jodhpur under the aegis of the SERB-INAE Conclaves on Atmanirbhar Technologies - Engineering Secured Future at IIT Jodhpur campus from 15 September to 18 September 2022. Youth conclave is an annual event promoted by INAE. The purpose of the event is to provide a platform to the country's youth to express their technological creativity and ingenuity and demonstrate their ability to innovate towards finding solutions that impact our collective future. In addition, participating in this event provides an excellent platform for students to interact with fellows of INAE and experts who have distinguished themselves with contributions in Engineering R&D, Industry and Academia. The theme of this fifth edition of Youth Conclave-2022 was: "Emerging Technologies for Sustainable Future".



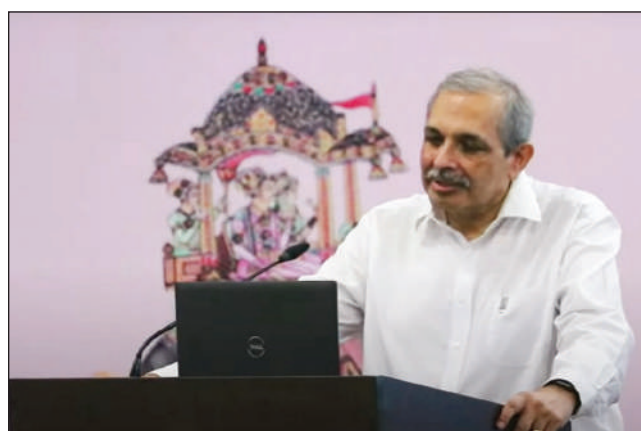
Welcome speech by Prof Santanu Chaudhury, Director
IIT Jodhpur



Opening Remarks by Prof Purnendu Ghosh,
Vice-President, INAE



Prof Indranil Manna, President, INAE delivering his
Presidential Address during Inaugural function



Prof Devang V Khakhar, FNAE,
Former Director of IIT Bombay,
the Chief Guest delivering his Address



Dr R Chidambaram, Chairman, BoG, IIT Jodhpur and Former Principal Scientific Adviser to GoI delivering his Address



Participants at Game Jam Competition



Participants at Hackathon



Prof Indranil Manna, President, INAE delivering Address during Valedictory session



Prof Ashutosh Sharma presenting certificates to the Awardees

The specific focus areas identified to anchor the Conclave were as follows:

- Quantum Technologies
- Smart Infrastructure
- Digital Healthcare
- Materials for Sustainability
- Experiential Interface
- Sustainability of Drinking Water
- Food: An Emerging Vista of Engineering

Apart from the Technical Sessions which involved Invited talks and Paper / Poster presentations in the above identified focus areas, several other events like Hackathon, Ideathon, Game Jam, Start-up Show Case, and 3-Minutes Thesis Presentation were conceptualized, planned and implemented. The inaugural session involved the celebration of Engineers Day marking the birth anniversary of the country's foremost engineer, Bharat Ratna Visvesvaraya. The gathering was addressed by the Chief Guest Prof Devang Khakhar (IIT Bombay), Guest of Honour Prof Purnendu Ghosh (VP, INAE), IIT Jodhpur's Chairman Prof R Chidambaram, Prof Indranil Manna (President INAE) and Prof Santanu Chaudhury (Director, IIT Jodhpur). Technical sessions involving invited lectures by external guests and INAE Fellows, in the focus areas as per the theme of this year's Youth Conclave were held along with paper / poster presentation by participating students. The speakers for Quantum Technology seminar organized on September 16-17, 2022 were as follows:

- (i) Dr. Anupama Ray for Introduction to IBM Quantum Computing
- (ii) Mr. Godfrey Mathias for Quantum Computing and application
- (iii) Prof. Prasanta K. Panigrahi for Emergence of quantum technology and Quantum computation
- (iv) Dr. Subimal Deb - Self imaging in dielectric slab waveguides: paraxial and beyond.

The speakers for Smart Infrastructure seminar organized on September 16-17, 2022 were as follows:

- (i) Dr. Aloknath De - Envisioning 6G enabled cyber physical world
- (ii) Mr. Vivek Sirohi and Mr. Abhishek Singh - Smart Infrastructure
- (iii) Prof. Pranab Kumar Mohapatra - Integral water management for Smart cities

The speakers for Digital Healthcare seminar organized on September 16-17, 2022 were as follows:

- (i) Dr. Bala Pesala (Ayur.AI, IIT Jodhpur) – Future of Digital Health: Living beyond 120 years
- (ii) Dr. Rakesh Sarwal (Director, NMDFC) - Digital Health: Opportunities for an efficient health care system in India



The speakers for Materials for Sustainability seminar organized on September 16-17, 2022 were as follows:

- (i) Prof. Bhanu Sankara Rao- Sustainability of Materials at elevated temperature in Energy sector
- (ii) Prof. Satyam Suwas – Tryst with materials engineering.
- (iii) Dr. Gerald Tennyson, Senior Scientist: Accelerating material design for sustainability through digital technologies

The speakers for Experiential Interface seminar organized on September 16-17, 2022 were as follows:

- (i) Dr. Avinash Sharma - Learning based 3D Digitisation of Humans & Terrains
- (ii) Dr. Lipika Dey Conversational Systems: Carrying on the conversation
- (iii) Dr. Rajendra Nagar - Introduction to Metaverse
- (iv) Prof. C V Jawahar - Towards Safe Driving in Unstructured Environments

The speakers for Sustainability of Drinking Water seminar organized on September 16-17, 2022 were as follows:

- (i) Prof P K Tiwari and Dr Anand Plapally - Energy for Pushing Water and Lifting It
- (ii) Prof Sirshendu De - Scalable and Sustainable Indigenous Technologies for Treatment of Groundwater and Industrial Wastewater

The speakers for Food an emerging vista of engineering seminar organized on September 16-17, 2022 were as follows:

- (i) Dr. C. Anandharamakrishnan, Senior Scientist CSIR – CFTRI, Mysore
- (ii) Mr. Arun Tangri, Tagtaste Foods Pvt Ltd

The 3-minute thesis presentation or 3MT was organized where research scholars were challenged to present and state the significance of their research/ thesis in 180 seconds, in an engaging manner to an audience with non-research background. Ninety-four students registered in thesis presentation. A hackathon, an intense competition was organized with a time constraint where participants collaborate to develop POCs to address a specific issue. In this competition, a group of participants wrestled with a given a problem statement to come up with a solution and demonstrate it with a proof -of-concept(POC). The total number of students who registered were 862.

Ideathon were brainstorming events where people with diverse knowledge backgrounds, skill-sets and interests get together to wrestle with predetermined problems, and come up with substantive, innovative and comprehensive solutions. An ideathon's output might be ideas, a roadmap or an actionable plan. Ideathon was organized where 236 teams comprising 907 students registered.



Over 200 students collectively attended the above session. The vote of thanks was proposed by Prof SR Vadera (Dy. Director, IIT Jodhpur). Apart from the Technical Sessions which involved invited talks and Paper / Poster presentations in the above identified focus areas, several other events like Hackathon, Ideathon, Game Jam, Start-up Show Case, and 3-Minutes Thesis Presentation were conceptualized, planned and implemented. The participation in each event was by nomination of the individual students (Technical Paper and 3 Minute Thesis Presentation) and student groups of 3-5 members (for Hackathon, Ideathon and Game Jam) by the Head of respective institutions who accepted the invitation to participate in the Youth Conclave. Shortlisting for each event was done based on evaluation of the preliminary submissions made by aspirants and final invitations were sent to the shortlisted individuals / teams. During the Conclave, final rounds of each of the five competitions were held. Prizes were presented to the winning individuals / teams during the Valedictory session on the 18th of September 2022. In addition, all the participating students were provided a Certificate of Participation. The large number of students who participated from across the country and events being high in technical content, showed the outstanding success of the event which benefitted engineering students in a unique and exemplary manner.



Joint INAE-SERB Scheme to Promote Translational Research in Engineering Abdul Kalam Technology Innovation National Fellowship

Indian National Academy of Engineering (INAE) and Science and Engineering Research Board (SERB), Department of Science and Technology (DST) had launched the INAE-SERB, DST Abdul Kalam Technology Innovation National Fellowship in the year 2017 to recognize, encourage and support translational research by Individuals working in various capacities of engineering profession, in public funded institutions in the country. A total of thirty-seven nominees have been conferred the subject Fellowship so far. A financial support of upto Rs 19 lakhs per annum is given to the selected fellows towards research grant, honorarium and overhead expenses. The cut-off date of receipt of nominations for this Financial Year was June 30, 2022. Further details are available on INAE website at the link <https://www.inae.in/research-innovation/abdul-kalam-technology-innovation-national-fellowship-2019-20/>

Ten Fellows were selected in this FY 2022-23. At present, 45 fellows are functional under the scheme and the work done by these fellows have reached the stage of technology transfer to start-ups and strategic areas to include 53 patents being filing/granted so far. As per the guidelines of the fellowship, the duration of the Fellowship will be initially for three years, extendable by up to two more years depending on the performance. The fellowship can be held for a maximum of 5 years. All fellowships are reviewed on completion of three years, and if the progress is found to be in line with the proposal, an extension of additional two years is granted to the fellow. The performance of seven fellowships completing their tenure of three years on January 31, 2023 were reviewed by the Search Cum Selection Expert Committee (SSEC) during its meeting held on December 2, 2022 in hybrid mode, 7 existing Fellows were recommended for extension of tenure of Fellowship by another two years. The call for nominations is open and being invited with the last date for the receipt of nominations being June 30, 2023. The call for nominations was posted on INAE Website and can be viewed at the link <https://www.inae.in/abdul-kalam-technology-innovation-national-fellowship/>

Advertisements inviting nominations for the subject fellowship were also placed nationwide in newspapers such as Times of India in the following editions - New Delhi, Visakhapatnam, Panaji, Ahmedabad, Thiruvananthapuram, Bhubaneswar, Jaipur, Chennai, Hyderabad and Kolkata; Hindustan Times, Mumbai edition and Tribune, Chandigarh edition on April 23, 2023. Advertisements were also placed in leading Hindi Newspapers such as Navbharat Times, Raipur edition; Hindustan, Delhi edition besides several others.

So far 45 fellows have been conferred and the work done by these fellows have reached the stage of technology transfer to start-ups and strategic areas to include 27 patents being filing/granted so far. Translational research has been undertaken by the fellows conferred with INAE- SERB Abdul Kalam Technology Innovation National Fellowships. Out of 45 ongoing projects, so far 27 patents have been filed/progressed/ granted with due acknowledgement to the INAE -SERB scheme. To name a few, the patents pertains to the following areas:

- i. IoT based Healthcare
- ii. Medical and Assistive Devices for visually impaired
- iii. Innovative Medical products to create social impact
- iv. Nanostructured Semiconductor Gas Sensors

- v. Hinge mechanism
- vi. Ultrasonic Waveguide Sensor Systems
- vii. Language Based automated Computed Speech Signal Parameters
- viii. Radar-On-Chip Technology
- ix. Preparation of activated carbon using waste tea leaves
- x. System for Automated Assessment of fluency in Spoken Language
- xi. Industrial waste water Remediation Techniques
- xii. Adsorption based fluoride removal technology from ground water by Aluminum substituted hydroxyapatite (Al-HAp) incorporated wood charcoal
- xiii. LPG operated Fuel Efficient & Clean Porous Radiant Burner
- xiv. Real Time Image Enhancement: Rain and Fog Removal from Video
- xv. Fabrication of Microwave Varactors on Polymer Substrates Using Low-Temperature Crystallized Ferroelectric Thin Films
- xvi. Indigenous Non-Invasive Non-Contact Robust Portable Hand Device for Accurate Measurement of Bilirubin Level, Haemoglobin Level Concentration & Oxygen Saturation in Neonatal subject.
- xvii. Rotary Wing Unmanned Aerial Vehicle (UAV) Ruggedization and Hybrid Multirotor Vertical Take-Off and Landing (VTOL) Unmanned Aerial System (UAS) field trials for commercialization.

Significant Achievements/Technology Transfers

- Development of an Ultrasonic Waveguide based Skin Temperature Sensor for high temperature process tubes in Refinery with Trials in BPCL Refinery
- Developed an Ultrasonic Waveguide based Fluid Rheology & Temperature Sensor with Field-Trials underway in Saint Gobain Research India (SGRI)
- Startup of an Abdul Kalam fellow named Proficient Vision Solutions Private Limited has received National Award for Technology Startup from Technology Development Board in 2021 and CII Startuppreneur Award in 2019.
- Development of Unmanned Helicopter with high endurance capability was completed and demonstrated to Indian Army during a trial at MHOW for possible application for surveillance with more than 15 km range of operation.
- Biplane Tail-sitter drone with payload delivery capability was fully developed and “sold” to a private company (through start-up) for mid mile delivery application.

During the first meeting of Search cum Selection Expert Committee (SSEC) on August 5, 2022 the Committee shortlisted seventeen nominees, after detailed deliberations, based on the degree of translational research leading to deployable technology as indicated in the proposals received. The seventeen nominees were segregated in two parallel Groups – Group A and Group B based on the area of engineering/specialization. Based on detailed presentation delivered by the nominees, followed by Q&A on August 25, 2022, the Committee selected ten nominees to be conferred as Abdul Kalam fellows for Financial Year 2022-23.



List of ten Nominees conferred with Abdul Kalam Technology Innovation National Fellowship in Financial Year 2022-23:

- **Prof Amit Mehndiratta**, Centre for Biomedical Engineering, Indian Institute of Technology Delhi and All India Institute of Medical Sciences, New Delhi, shortlisted for his proposal on **“Robotic and Augmented Reality Virtual Reality enabled Assistive Technologies in Rehabilitation for upper-limb disability”**.
- **Prof Prasanna Subhash Gandhi**, Department of Mechanical Engineering, IIT Bombay, shortlisted for his proposal on **“Productization and field trials of Spanda1: India’s first 3D SLA microprinter based on resonant displacement amplification of compliant mechanisms”**.
- **Prof Shyamanta M Hazarika**, Mechanical Engineering, Indian Institute of Technology Guwahati, shortlisted for his proposal on **“Intelligent Wearable Hand Exoskeleton for Robotic Neurorehabilitation”**.
- **Dr Praveen Kumar**, Department of Materials Engineering, Indian Institute of Science, Bangalore, shortlisted for his proposal on **“Prototype development + Incubation of a start-up company: Pattern creation at micro-and nano-scales using electric field induced reaction and subsequent flow of liquefied reaction product”**.
- **Dr Palash Kumar Basu**, Indian Institute of Space Science and Technology, Valiamala, Thiruvananthapuram, Kerala shortlisted for his proposal on **“Design and Development of Low Power, Low Cost, High-Performance Gas Sensor Array for Exhale Breath analyzer: A Point-of-Care based Non- Invasive Early Detection and Prognosis of Cardiovascular Diseases”**.
- **Dr. S Venkata Mohan**, Senior Principal Scientist, CSIR-Indian Institute of Chemical Technology, Hyderabad, shortlisted for his proposal on **“CO₂ to Value-added Products: Sustainable Process Development for Succinic acid and Hexanol Production through Hybrid Fermentation Route”**.
- **Prof. Udayan Ganguly**, IIT Bombay, shortlisted for his proposal on **“Design for Secure Indigenous Spiking Neural Network Chip with OTP Memory on 180nm CMOS for Voice Recognition”**.
- **Prof. Kedar Khare**, Associate (Institute Chair), Optics and Photonics Centre, Indian Institute of Technology Delhi shortlisted for his proposal on **“Lens-less Computational Microscopy: Concepts, Devices and Bio-Medical Applications”**.
- **Prof. Mahesh Kumar**, Department of Electrical Engineering, Indian Institute of Technology Jodhpur shortlisted for his proposal on **“IoT enabled 2D Materials functionalized AlGa_N/Ga_N transistor for water quality monitoring”**.
- **Prof. Dipanwita Roy Chowdhury**, Department of Computer Science & Engg, IIT Kharagpur shortlisted for her proposal on **“Design and Implementation of Secure Implantable Medical Devices (IMDs)”**.

Reaching out to Policy Makers: Interaction with Government Agencies

The following meeting of joint Consultative Committees with INAE were held during the year.

(i) DAE-INAE Consultative Committee Meeting on April 22, 2022

A meeting of the DAE-INAE Consultative Committee was held on April 22, 2022 at DAE, Mumbai in hybrid mode. The following broad areas were finalized to be taken up for discussion during the first meeting of DAE-INAE Consultative Committee:

- i. Energy excluding coal (carbon free energy resources including hydrogen)
- ii. Water (including desalination, purification and waste water treatment)
- iii. Advanced materials (for nuclear and energy generation units)
- iv. Directed beam assisted processing technology (ion, electron, laser) including additive manufacturing and joining

Members of the Committee recommended INAE to organize conferences to bring together academicians, technology developers and users to add value to technology. A few salient areas identified, besides the four above mentioned themes are as follows:

- i. Energy harvesting
- ii. Sustainable energy solutions for various energy sources excluding Coal
- iii. Role of Nuclear energy for production of Hydrogen
- iv. Usage of concentrated solar energy for better efficiency than solar energy
- v. Effective utilization of all energy resources and user
- vi. Rare earth sector (hard magnets)

(ii) ISRO-INAE Consultative Committee Meeting on May 5, 2022

A meeting of the ISRO-INAE Consultative Committee was held on May 5, 2022 at Bangalore. Besides planning for the conduct of Engineers Conclave 2022, to be organized jointly with ISRO at Thiruvananthapuram, the objective of this meeting was also to identify topics for joint collaboration between the two organizations. A meeting of the former Presidents was also held on the sidelines of the meeting to discuss the methodology to take the Academy forward.



Left to Right: Dr. V Narayanan, Dr. BN Suresh, Mr. AS Kiran Kumar, Prof. Indranil Manna, Mr. S Somanath, Dr. PS Goel, Prof. Sanjay Mittal and Lt Col Shobhit Rai (Retd) at ISRO, Bangalore



Left to Right: Prof Sanjay Mittal, Prof Indranil Manna, Dr. K Kasturirangan, Dr. PS Goel and Dr. BN Suresh at ISRO, Bangalore

(iii) DST-INAE Consultative Committee Meeting on May 27, 2022

A meeting of the DST-INAE Consultative Committee was held at New Delhi on May 27, 2022 to discuss the activities carried out by INAE under the Azadi Ka Amrit Mahotsav celebrations, joint projects with SERB, projects undertaken at the behest of DST and constitution of a new Technology Forum on 'Net-zero Energy Security Policy for India'. The plan for generating funds for achieving self-sufficiency was also discussed

(iv) DRDO-INAE Consultative Committee: A DRDO-INAE Consultative Committee Meeting was held on June 17, 2022 to discuss joint collaborative activities between INAE and DRDO. The Chairman, DRDO and the President, INAE are the Co-Chairs and a few senior officials from DRDO and eminent Fellows from INAE are the members of this Committee.

(v) CSIR-INAE Consultative Committee Meeting on February 27, 2023

CSIR-INAE Consultative Committee Meeting was held on February 27, 2023 wherein a brief presentation was made on the activities of INAE. A few of the futuristic areas identified wherein INAE and CSIR can collaborate suggested are as follows: Clean Hydrogen; Carbon Capture; Future of Communication; Future of Mobility; Promoting education in engineering and technology at higher level and to Enhance the skills of young engineers from industries. During the meeting, it was decided that INAE could contribute at a project level for technical consulting as well as monitoring, pointers for challenges etc. This could be initiated once the specific targets/areas are identified by CSIR and shared with INAE so as to identify domain experts at INAE. The way forward for joint collaborative activities was discussed.

(vi) SERB-INAE Consultative Committee Meeting on March 6, 2023

SERB-INAE Consultative Committee Meeting was held on March 6, 2023 which was attended by Secretary, SERB; President, INAE and Members of the Committee from INAE and SERB. A presentation was made by INAE on flagship events held each year. Progress on the joint programmes of INAE with SERB viz INAE-SERB Abdul Kalam Technology Innovation National Fellowship; INAE-SERB Collaborative Initiative in Engineering and INAE -SERB Digital Gaming Research Initiative was discussed. Discussions on the way forward for future collaborative activities as well as continuing of present joint initiatives were deliberated. It was suggested to develop an "Industry-Academia flagship program" to lead to the outcome of technology transfer/commercialization through project proposals with impactful results.

INAE Forums

One of the important objectives of the Academy is to assist the Government from time to time in formulating policies on critical technical issues. For this purpose, five forums were constituted – INAE Forums on Energy; Technology, Foresight and Management; Engineering Interventions for Disaster Mitigation; Indian Landscape of Advanced Structural Materials and Civil Infrastructure. These forums enable giving inputs to policy makers, institutes of higher learning & research, industries, etc.

INAE Forum on Engineering Interventions for Disaster Mitigation

The Forum on Engineering Intervention for Disaster Mitigation, established by the INAE on 8 August 2013, was reconstituted. It's Vision and the Objectives were decided from time to time, based on the emerging national priorities and the collective wisdom of the members of the Forum. It has largely contributed via roundtable meetings, participation in national events, publication of papers delivery of reports with actionable recommendations delivered and the reports submitted to the relevant agencies of the Government of India.

Upon the reconstitution of the Forum in 2021, Prof. D.N. Singh launched a project on “Valorisation of industrial by-products”. A note on the project submitted to the Forum in its meeting held concurrently with the INAE Annual Session in 2018, developed into a major project of the Forum through subsequent discussion meetings, approved and sanctioned by the INAE. After making substantial progress through national level consultations, roundtable meetings and discussions held at the Forum, the project had to be slowed down and concluded prematurely. The findings are proposed to be published.

The other items on the agenda of the Forum were (1) strategy and road map for shift of focus from individual to multi-hazard Engineering Interventions with focus on Safe & Sustainable multi-hazard risk resilient infrastructure in the context of the Sendai Framework (2015-2030) for Disaster Risk Reduction, (2) Engineering Interventions in Preservation and Protection of Heritage Structures in Hazardous Areas, (3) World Class Infrastructure: Climate Change and Transition to Carbon Neutrality and (4) Sundarbans preservation & eco-friendly infrastructure. Consultations between the members were in progress to review various options and firm up the agenda of the Forum.

To make the activities of the forum more impactful, members presented the current status on the following in subsequent meetings:

1. Valorization of Industrial By-Products (Prof. D. N. Singh)
2. Safe & Sustainable multi-hazard risk, resilience infrastructure (Ms. Alpa Sheth)
3. a) Sunderbans preservation & eco-friendly Infrastructure (Prof. SS Chakraborty)
b) World Class Infrastructure: Climate Change and Transition to Carbon Neutrality (Prof. SS Chakraborty).



Meeting of INAE Forum on Engineering Interventions for Disaster Mitigation held on April 16, 2022 through VC

A meeting of the INAE Forum on Engineering Interventions for Disaster Mitigation was held on April 16, 2022 through VC. This forum discussed the development of the strategies that would facilitate mitigating natural and manmade disasters that the present-day civilization is witnessing. Apart from a very high priority project on “Valorization of Industrial By-Products” the following two were included in the Forum’s new Agenda.

- a. Safe & Sustainable multi-hazard risk, resilience infrastructure
- b. Sunderbans preservation & eco-friendly infrastructure
- c. Interlinking of Rivers
- d. (Civil) Engineering Challenges exasperated by urbanization, Climate Change and rapid pace of development
- e. Engineering Interventions in Preservation and Protection of Heritage Structures in Hazardous Areas
- f. Critical assessment of market-driven new emerging technologies for development in hazardous area
- g. Tapping the Power of New Technologies in the context of Disaster Mitigation and the associated Technology Hazards, and
- h. Forecasting and Early warning against Multiple Hazards.

The views of the Members were sought by Prof DN Singh, Chairman of the Forum and the way forward was discussed.

INAE Forum on “Technology Foresight and Management for Addressing National Challenges”

INAE Forum on Technology Foresight and Management for addressing National Challenges was constituted in the year 2012. The mandate of the Forum was to evolve solutions keeping in view the issues of sustainable development, poverty reduction, and climate change in focus and suggest appropriate technologies accordingly. This Forum was chaired by Late Mr VK Agarwal, FNAE & Formerly Chairman, Railway Board since 2012. Due to sudden demise of Mr VK Agarwal, the INAE Fellows who were members of this Forum had a virtual meeting on March 9, 2022 to discuss the way forward.

The next Meeting of the INAE Forum on Technology Foresight for addressing National Challenges held on May 13, 2022 in physical mode at INAE office, Ground Floor, Block-II, Technology Bhavan, New Mehrauli Road, New Delhi. The following salient points were discussed (i) The Forum may be renamed as Forum on Technology Foresight and Management - Phase II. That will reflect its effectiveness in phase I and potential in future. (ii) The objectives and tenure will be aligned with the guidelines of any INAE Forum. (iii) It will focus on futuristic technologies in few select areas considered relevant for government programmes (iv) The Forum will develop documents and reports on relevance, policy, strategy, cost-effective technology application route, and various elements of make in India and (v) Following three areas were identified for initial action:

- i. Industry 4.0/5.0 and Emerging Technologies including digitisation.



- ii. Promoting Circular Economy by material management through recovery of materials from e-waste.
- iii. Engineering for Climate Resilience and SDGs.

Forum on Civil Infrastructure

The report on Study on “Housing in India – Challenges & Way Forward” incorporating all inputs from invited experts published by INAE Forum on Civil Infrastructure was released during the INAE Annual Convention 2022 held on December 14-16, 2022 at Bhabha Atomic Research Centre (BARC), Mumbai.

INAE Forum on Indian Landscape of Advanced Structural Materials

Book published on “Future Landscape of Structural Materials in India”.

INAE, mandated to promote excellence in engineering profession and policies, constitutes engineering forum on specific topics or themes both of contemporary relevance and futuristic ambition. In this direction, the INAE Forum on Indian Landscape of Advanced Structural Materials was created to review the current status of availability, quality and adequacy of structural (load bearing) materials in India and outline the gap and challenges to be overcome to meet the current and futuristic demands in construction, strategic, aerospace, automobile, energy and all other important sectors. The challenges lie not just in raw material, equipment and competence, but also in creation of demand and sustenance of interest and business. The INAE Forum on Indian Landscape of Advanced Structural Materials published a special volume on “Future Landscape of Structural Materials in India” with very well researched articles addressing specific thematic areas authored by the most eminent engineers and technologists of the country. This is a ready reference to the planners, researchers, entrepreneurs and industry leaders both from civilian and strategic sectors in the country for developing advanced structural materials encompassing metals and alloys, ceramics, polymers, composites and hybrids that will make India both self-reliant and technologically advanced.



Joint Schemes with AICTE

AICTE-INAE Distinguished Visiting Professorship Scheme

Industry-academia interactions have become essential with world-over technological changes in recent times. The interactions can impart relevant knowledge to the students in the engineering institutions, which is sustainable in the changing conditions. The exchange of knowledge proves to be beneficial for both academic institutions and industries. While industries could use the Academia's knowledge base to improve the industry's internal R&D, quality and global competitive dimensions, academicians benefit from gaining knowledge about dynamics of Industrial real time situations, identifying problems for improved research and using their knowledge and expertise to find practical solution and strengthening of curricula of educational programs being offered at engineering colleges/institutions. INAE together with All India Council for Technical Education (AICTE) launched "AICTE-INAE Distinguished Visiting Professorship Scheme" in 1999. Under this scheme, Industry experts are encouraged to give lectures in engineering institutions. This scheme was popular among industry experts as well as engineering colleges. Due to prevalence of Covid pandemic, the scheme was operated on the modified Standard Operating Procedure (SOP) allowing existing DVPs conduct online. Existing 54 DVPs conducted classes with their respective associated colleges. With the travel restriction being removed, some of the DVPs started travelling to campus of their associated engineering colleges and giving lectures in person.

The total number of Distinguished Visiting Professors whose tenure was effective from July 2021 to June 2022 was 54 and they were associates with 69 AICTE approved engineering colleges all over India. The break up is as follows: The Selection Committee selected 16 Distinguished Visiting Professors effective from July 1, 2021. Out of these 16 DVPs, there were 7 Retired INAE Fellows and 9 were Industry Experts from outside INAE Fellowship. The performance of existing DVPs were reviewed and extension of tenure was granted to 18 INAE Fellows and 20 Industry Experts. These Industry Experts delivered lectures online and physically to the students of the affiliated Engineering Institutions. During April 2022, 21 lecture days were recorded as per the documents received from faculty coordinators of 8 associated colleges. The Scheme was put on hold from May 2022 as per notification received from AICTE.

Brief details pertaining to visits of industry experts in The Financial Year 2022-23 under this scheme are given below.

Prof. Rajendra Prasad Chhabra, FNAE Retired Professor, IIT Kanpur, Mentor and Visiting Professor, IIT Ropar	Shaheed Bhagat Singh State Technical Campus, Punjab Apr 20-22, 2022	Delivered lectures on "Soft Matter and Non-Newtonian Behaviour- Part I", Soft Matter and Non-Newtonian Behaviour- Part II" and Soft Matter and Non-Newtonian Behaviour- Part III". As per the feedback received from the college, more such lectures are required, and classes have been scheduled in May 2022.
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<p>Dr. SL Mannan, FNAE Former Outstanding Scientist and Director Metallurgy and Materials Group, Indira Gandhi Centre for Atomic Research, Kalpakkam</p>	<p>Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai</p> <p>Apr 18-20, 2022</p> <p>Government College of Engineering, Salem</p> <p>Apr 11-13, 2022</p>	<p>Delivered lectures on “Fundamentals of dislocation behaviour and strengthening mechanisms”, “Creep, creep testing, mechanism of creep, deformation maps, grain boundary sliding and creep fracture” and “Creep data extrapolation, design and selection of high temperature materials, steels and super alloys, creep designing”. As per the feedback received from the engineering college, the interactions were very useful for the students regarding the related topics of creep testing. More interactions are desired in future.</p> <p>Delivered lectures on “Fundamentals of dislocation behaviour and strengthening mechanisms”, “Creep Deformation, Creep and Stress rupture testing, Creep Mechanisms- Dislocation Creep and Diffusional Creep”, ‘ Deformation Mechanisms Maps, Creep fracture, Time-Temperature parameters, Selection of materials for high temperature service”. As per the feedback received from the engineering college, the interactions with the DVP were quite intense and benefitting. Both students and faculty members would like such interactive classes in future in the thrust areas.</p>
<p>Dr. Debabrata Das, FNAE Retd. Prof. IIT, Kharagpur, Renewable Energy Chair Professor,</p> <p>Department of Biotechnology, Professor in Charge, P K Sinha Centre for Bioenergy IIT, Kharagpur</p>	<p>Heritage Institute of Technology, Anandpur, Kolkata</p> <p>Apr 4-7, 2022</p> <p>Apr 11, 13 & 18, 2022</p>	<p>Delivered lectures on “Advanced biofuel production processes using renewable resources”, “Fundamentals and technology advances of biohydrogen production processes” and “Effect of bioreactor configurations on the biofuel production”. As per the feedback received from the college, the lectures have been pertaining to the course of BTech and MTech and have been beneficial for the students.</p> <p>Delivered lectures on “Thermodynamics and Kinetics of Biomethanation process”, “Biohythane: fuel for the future” and “Scale-up and Case studies of biofuels production processes”. As per the feedback received from the college, the interactive session with faculty members and the students have been highly beneficial for research activities of the department.</p>



Dr. Satyanarayana Bheesette Scientific Officer (H), TIFR, Mumbai, Coordinator, India-based Neutrino Observatory (INO) Project Visiting Professor, Dept. of Applied Science, American College, Madurai	Symbiosis Institute of Technology, Mulshi Apr 7-8, 2022	Delivered lectures on “ Introduction to mathematical modelling and Simulation in Engineering”, “Discussion on E&TC curriculum of batch 2022-26” and “Why and How to do research in an academic institution?”. As per the feedback received from the engineering college, the scheme provides a platform to interact with young minds and gave an opportunity to discuss student projects which helped them modify/extend their projects. The scheme helps to establish linkages between industry and engineering institutions which can help to enrich the curriculum.
Dr. Rabindra Nath Ghosh, FNAE Chair Professor, Metallurgical & Materials Engineering Dept., IIT, Kharagpur	College of Engineering, Pune Apr 10 & 12, 2022 Apr 2 & 13, 2022	Delivered lectures on “NDT/ NDE/ NDI: basic concepts, VI, PT, MT”, “Eddy current & ultrasonic tests, type of probes, test methods & its scope & limitation”. As per the feedback received from the engineering college, the DVP helped in framing out the syllabus NDT course. Delivered lectures on “Failure analysis: Why components fail; how to find its cause”, “Failure Mechanisms & characteristic signatures” and “Metallurgical failures: case studies”. As per the feedback received from the college, the course on “ Failure Analysis of Engineering Materials” has been introduced recently in college and the lectures offered by the DVP was extremely useful. More interactions are required.

Presently the scheme is still on hold due to directives received.

AICTE-INAE Travel Grant Scheme: The Scheme was instituted in 2013 jointly with AICTE for enhancing the quality of engineering education and encouraging research work among engineering students. The scheme provides travel assistance to Bachelor’s and Master’s Level engineering students for presenting research paper/ research project at international scientific events (conference/ seminar/symposium/ workshop/ exhibition etc). With the travel restriction imposed due to COVID the scheme was extended to facilitate students attend international virtual conferences also. 190 students have been benefitted till date. With the travel restriction imposed due to COVID the scheme was extended to facilitate students attend international virtual conferences also. Two candidates were selected under the scheme during April- June 2022. The scheme was on hold due to directives received.

Events Organized by Local Chapters

INAE Local Chapters organized a number of interesting webinars/activities in the last one year some of which are summarized below.

INAE Kanpur Local Chapter

INAE-SERB Conclave on Atmanirbhar Technologies: Engineering a Secure Future on November 5-6, 2022
(already covered in joint SERB-INAE initiative)

One-day workshop on standardization and Conformity Assessment on March 2, 2023

A One-day workshop on standardization and Conformity Assessment was jointly held by the Advanced Centre for Materials Science (ACMS), INAE Kanpur Chapter and Materials Advantage Student Chapter at IIT-Kanpur, as part AIN ACMS) of collaboration between Bureau of Indian Standards (BIS) and IIT-Kanpur on March 2, 2023 at IIT Kanpur. The workshop was jointly organised by the Advanced Centre for Materials Science (ACMS), INAE Kanpur Chapter and Materials Advantage Student Chapter. Over 100 delegates comprising students, staff and faculty members attended the workshop on Standardisation and Conformity Assessment. IIT Kanpur and BIS have signed an agreement earlier to boost the coordination between the two organizations. Welcoming the participants of the workshop, head of ACMS Professor Anish Upadhyaya highlighted the need to have well-structured product and process standards for better quality, consistent products and robust practices. Highlighting the need for standards and their benefits, former Deputy Director General and current Consultant at BIS Jayanta Roy Chowdhury, in his address, shared details on the recently formulated Standards National Action Plan (SNAP) and the emerging areas of standardisation. SNAP and the emerging areas of standardisation necessitate active cooperation and collaboration between various stakeholders and provides opportunities for engaging students, research scholars and faculty of IIT Kanpur.

INAE Kolkata Local Chapter

Celebrations of National Technology Day 2022 on 11th May 2022

INAE Kolkata Chapter celebrated National Technology Day 2022 on 11th May 2022 which was jointly organized by INAE and SN Bose National Centre for Basic Sciences (SNBNCBS) at Silver Jubilee Hall, SNBNCBS, Kolkata. On this occasion, two lectures were delivered by eminent Fellows, viz., (i) Prof. Indranil Manna, Vice-Chancellor, Birla Institute of Technology (BIT), Mesra and President, INAE; and (ii) Prof. Suman Chakraborty, Dean (SRIC) and Professor, Department of Mechanical Engineering, IIT Kharagpur. The Welcome Address was delivered by Dr. BN Jagatap, Professor, Department of Physics, IIT Bombay and Chairman, Governing Body SNBNCBS. An Introduction was given by Prof. Tanusri Saha Dasgupta, Director, SNBNCBS. Prof Samit Kumar Ray, Professor, Department of Physics, IIT Kharagpur and Adjunct Professor, SNBNCBS briefed about Centre's Technological Activities and the Vote of Thanks was proposed by Professor Soumen Mondal, Nodal Officer, TRC, SNBNCBS.

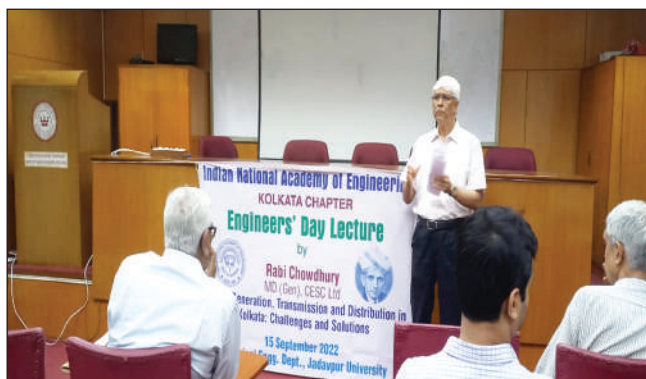


Celebrations of Engineer's Day 2022 on 15th September 2022

INAE Kolkata Chapter celebrated Engineer's Day 2022 on 15th September and organized a special lecture on "Power Generation, Transmission and Distribution in Kolkata - Challenges and Solutions" delivered by noted Engineer and industry leader Mr. Rabi Chowdhury, Managing Director, CESC Limited Kolkata. The event was organized at the Seminar Hall of the Electrical Engineering Department, Jadavpur University. Prof. Sivaji Chakravorti, Vice President INAE presided over the lecture meeting. He explained the significance of the day and also the activities of INAE to the audience. Prof. Debatosh Guha, President INAE Kolkata Chapter welcomed the participants and introduced the speaker. The lecture was attended by INAE Fellows and faculty members, research scholars and students of Jadavpur University.

In his lecture, Mr. Chowdhury elaborated the evolving technologies in power generation, transmission and distribution in the city of Kolkata particularly focusing on the challenges and solutions. He discussed the historical perspectives of power supply in the city and illustrated the present-day challenges regarding environmental regulations, dwindling coal quality and coal import and introduction of power from renewables to the grid. Through lucid explanations of technical theories, Mr. Chowdhury could attract the attention of the audience throughout the lecture who later interacted overwhelmingly with the speaker on various issues.

Prof. Amitava Datta, Secretary and Treasurer of INAE Kolkata Chapter proposed the vote of thanks at the end of the lecture.



Prof. Sivaji Chakravorti, Vice President INAE, explaining the significance of the day to the audience



Prof. Debatosh Guha, President INAE Kolkata Chapter, greeting Mr. Rabi Chowdhury the speaker of the day



Mr.. Rabi Chowdhury, MD CESC Ltd presenting the Engineer's Day 2022

Prof. Arun Kumar Choudhury Birth Centenary Symposium on “From Switching Theory to Quantum Computing” on January 8-9, 2023

Prof. Arun Kumar Choudhury Birth Centenary Symposium on the theme “From Switching Theory to Quantum Computing” organized jointly by INAE Kolkata Chapter in collaboration with The Department of Computer Science and Engineering, University of Calcutta, and the A. K. Choudhury School of Information Technology of the University of Calcutta on January 8-9, 2023 to commemorate the birth centenary of Prof. A. K. Choudhury (1923-1987), who was an illustrious computer scientist in India during 1950-1980’s. He pioneered research in several areas of electrical and computer Engineering in India such as analog computers, circuit theory, control engineering, switching theory and logic design, VLSI circuit testing, and graph theory. Apart from teaching numerous undergraduate and graduate students, he mentored around 60 Ph.D. students, who subsequently became eminent in their respective fields. In 1980, he established the Department of Computer Science at the University of Calcutta. He had left an illustrious legacy behind, and an indelible mark of inspiration among the contemporaries, and in the minds of thousands of students he had taught.

The theme of the symposium was “From Switching Theory to Quantum Computing” that aptly reflects the wide scope of Prof. Choudhury’s research work. The symposium was graced by several invited talks, student presentations, panel discussions, and reminiscences on the life and work of Prof. Choudhury as narrated by his former students and peers. The programme comprised of four technical sessions namely, Signals and Systems, Distributed and Mobile Computing, Next Era of Computing, and Smart CPS/IoT and Machine Learning, where distinguished speakers from academia and industry presented invited talks. Two interactive panel sessions were conducted: one on CSE Higher Education in India, and the other on Innovation and Entrepreneurship. In addition, several past students and colleagues of Prof. Choudhury spoke about their personal experiences and anecdotes in two special sessions on remembrances.

An exciting Poster Session on Students’ Research Work had also been organized and the prizes were sponsored by the INAE Kolkata Chapter. The research posters were selected from the submissions received from diverse institutions on a competitive basis. Prof. Debatosh Guha, FNAE, President of the INAE Kolkata Chapter, handed over the prize money and citations to the winners. A marble statue of Prof. A. K. Choudhury had been unveiled at the Department of Computer Science and Engineering, University of Calcutta, Salt Lake Campus, Kolkata, following the inaugural program of the symposium. Further details of the AKC100 Symposium and YouTube videos can be found at: <https://sites.google.com/view/akc100symp>



Prof. Arun Kumar Choudhury Birth Centenary Symposium -Group Photograph



Prof. Arun Kumar Choudhury Birth Centenary Symposium – Glimpses of Delegates

Lecture on ‘Space Technology for the Last Mile Application’ on February 15, 2023

INAE Kolkata Chapter in association with IEEE AP/MTTs Kolkata Chapter and its associated Student Branch Chapters organized a lecture meeting in the afternoon of February 15, 2023 at B. R. Nag Auditorium of Institute of Radio Physics and Electronics, Science College Rajabazar Campus of the University of Calcutta. Shri Tapan Misra, FNAE, Founding Director and Chief Scientist, SISIR Radar Pvt. Ltd, Kolkata was the sole speaker and he talked on ‘Space Technology for the Last Mile Application’. In nearly one and half hour’s session, Shri Mishra elaborately discussed utilization of remote sensing and IR-imaging in satellite-based systems to get high resolution images of the earth for geographical survey. The lecture was attended by about 100 students and researchers who assembled from different Universities and Engineering Colleges in and around the city. It created an enormous interest among them as revealed from a lively question-answer session. At the end of the event, there was a pleasant surprise for the attendees to win lucky draws which were conducted by Mrs. Arundhati Misra, former Group Director of SAC, ISRO and two of lucky attendees had won the prize. Prof. Debatosh Guha, Chair, INAE Kolkata Chapter presided over the function and Dr. Kaushik Mandal, Secretary, IEEE AP/MTTs Kolkata Chapter conducted the event.



Felicitations by an IEEE Volunteer



Shri Tapan Mishra addressing the audience



A group photo with some UG Engineering students

National Science Day Celebration by INAE Kolkata Chapter on March 1, 2023

The Kolkata Chapter of Indian National Academy of Engineering (INAE) celebrated the National Science Day on March 1, 2023 at Dr J C Ray Auditorium of the Indian Institute of Chemical Biology (IICB), Jadavpur, Kolkata. Padma Shri Professor Sankar K Pal, National Science Chair, SERB, Govt. of India & President, Indian Statistical Institute and Dr. Arun Bandyopadhyay, Director, CSIR-Indian Institute of Chemical Biology (IICB) delivered Science Day lectures on this occasion. The function was attended by more than 70 participants of different ages and interests including about 12 Fellows of the Academy. Prof. Sivaji Chakravorti, Vice-President, INAE presided over the function and gave the welcome address. Professor Sankar K Pal talked on ‘Pattern Recognition, Machine Intelligence to Data Science: Evolution and Challenges’ and shared a part of his personal journey as a researcher since early 1970s. He addressed the evolution of the subject and its growth over the time. The one-hour talk was truly exciting and motivating to the young engineers and scientists present in the audience.

The program was steamed online, and many participants thus became able to enjoy the talks from the remote locations. It was followed by the second talk given by Dr. Bandyopadhyay which was based on some facts and philosophy of science. The title of his talk was “R&D is not Driven by Profit Alone”. He shared his experience and realization which he and his team gathered during the time of Covid 19 pandemic. He discussed how his research labs and scientists, apparently obscure to the common people, came to the forefront during the pandemic in saving lives. Both lectures created huge interest among the participants as revealed from the question answer sessions. Prof. Debatosh Guha, Chair, INAE Kolkata Chapter conducted the proceedings of the meeting and offered the formal vote of thanks. He thankfully acknowledged the help and support received from the Director and staff of IICB in organizing the event in their premises. There was a provision for a lucky draw announced to encourage the participants and that was held at the end of event. Mr. Subhajit Maur, a student of Jadavpur University, had won the prize.



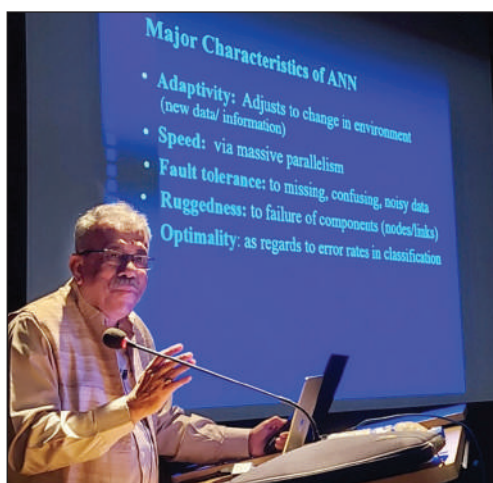
Prof. Sivaji Chakravorti welcoming the gathering



Prof. Sankar K Pal addressing the audience



The audience in Dr J C Ray Auditorium of the Indian Institute of Chemical Biology, Jadavpur, Kolkata



Prof. Sankar K Pal giving his talk



Dr. Arun Bandyopadhyay giving his talk



Token of appreciation for the speakers



Mr. Subhajit Maur won the lucky draw



INAE Bangalore Local Chapter

INAE Foundation Day celebrations by INAE Bangalore Chapter on April 23, 2022

INAE Bangalore Chapter organized INAE Foundation Day on April 23, 2022 with four Focussed Lectures on AI and Sustainable technologies. The lectures were delivered by four leading experts. The Welcome address was delivered by Prof. S. Gopalakrishnan, Aerospace Department and Secretary INAE Bangalore Chapter. The Introduction of Speakers was done by Prof. Neelesh Mehta, Professor, Department of ECE, IISc and Treasurer, INAE Bangalore Chapter. Dr A.P Pratos, Department of ECE, IISc, Bangalore delivered a talk on “Application of Deep Learning Methods in Health care and Behavioural Analysis”; Dr Umakanth Soni, ArtPark, IISc, Bangalore on “Opportunities for building AI & Robotics startups”; Dr LN Rao, Centre for Sustainable Technologies, IISc, Bangalore on “Gasification of Refuse Derived Fuel for value-added Products” and Prof. Monto Mani, Centre for Sustainable Technologies, IISc, Bangalore on “Sustainability challenges in the built environment”. A Report on INAE Bangalore Chapter Activity was presented by Prof. S. Gopalakrishnan, Department of Aerospace Engineering, IISc and Secretary, INAE Bangalore Chapter followed by Address of Dr V K Aatre, Chairman, INAE Bangalore Chapter. The Vote of Thanks was proposed by Neelesh Mehta, Treasurer, INAE Bangalore Chapter.

11th SAMVAAD Talk on 27th April 2022

INAE Bangalore Chapter organized a live session of 11th “SAMVAAD – an IIT Dharwad-INAE Bangalore Chapter Lecture Series” on 27th April 2022 (Wednesday) wherein a Lecture on “Kaleidoscopic flow in a liquid pool due to falling drops” was delivered by Prof. Gautam Biswas, FNAE, Professor and JC Bose National Fellow, Dept of Mechanical Engineering, IIT Kanpur.

12th SAMVAAD Talk on 25th May 2022

INAE Bangalore Chapter organized a live session of 12th “SAMVAAD – an IIT Dharwad-INAE Bangalore Chapter Lecture Series” on 25th May 2022 (Wednesday) wherein a Lecture on “Research, Innovation and Entrepreneurship at IITs for Atmanirbhar Bharat” was delivered by Prof. Ashok Misra, FNAE, NASI Platinum Jubilee Chair Distinguished Professor, IISc., Bangalore and Former Director, IIT Bombay.

INAE Bangalore Chapter Frontiers of Engineering Webinar Lecture Series “Learning for legged locomotion” on 23rd June 2022

INAE-BC Frontiers of Engineering Webinar Lecture Series featuring Lecture by Dr. Shishir N. Y. Kolathaya, Robert Bosch Center for Cyber Physical Systems (RBCCPS), Indian Institute of Science, Bangalore on “Learning for legged locomotion” was held on 23rd June 2022. He showed how reinforcement learning (RL) techniques can be used for realizing robust locomotion in custom built quadrupedal (four-legged) walking robots. He showed very interesting video demonstrations of three different types of walking robots Stoch1, Stoch2 and Stochlite that his team has developed that can learn to navigate different terrains. The talk elicited several questions and was attended by 15 people.



13th “SAMVAAD Talk on 28th June 2022

13th “SAMVAAD – an IIT Dharwad-INAE Bangalore Chapter Lecture Series” featuring Lecture by Prof. Ned Mohan, Fellow: IEEE, Regents Professor, National Academy of Engineering, Electrical and Computer Engineering, University of Minnesota on “Power Engineering Education in the Age of Climate Crisis - A Holistic View” was held on 28th June 2022. Prof Ned Mohan presented a holistic view of Power Engineering Education in wake of climate change. For benefit of a wider audience, the talk was live-streamed on YouTube (<https://youtu.be/31kAl8K33gU>).

Prof. Roddam Narasimha memorial lecture on “Challenges and Capability in Experimental and Computational Aerodynamics in Indian Space program” on 22nd July 2022

INAE-Bangalore Chapter instituted Prof. Roddam Narasimha memorial lecture every year on his birthday (July 20th) in the year 2021 to honour his contribution to Engineering and Technology. Every year, this event will be jointly organized by INAE-BC and NAL Bangalore. Professor Roddam Narasimha Inaugural Lecture was jointly organized by CSIR-NAL, Bangalore and INAE Bangalore Chapter by Dr S. Somanath, Secretary Department of Space and Chairman, ISRO on “Challenges and Capability in Experimental and Computational Aerodynamics in Indian Space program” on 22nd July 2022. It was organized at NAL and was webcasted for those who joined online. The event began with a welcome address from Introduction of speaker from Dr Venkatakrishnan, Chief Scientist, NAL. Following this Dr Somnath presented various Aerodynamic Challenges in Space vehicles and presented several case studies on how they overcame these challenges. INAE-BC was represented by Prof. M L Munjal, executive council member of INAE Bangalore Chapter and INSA Scientist, IISc Bangalore. The acting director of NAL Dr Bhowmik also addressed the gathering. Prof. Gopalakrishnan, Secretary, INAE-BC proposed the vote of thanks. The Lecture was attended by over 200 people with over 700 people heard the lecture through webcast

14th “SAMVAAD Talk on 27th July 2022

14th “SAMVAAD – an IIT Dharwad-INAE Bangalore Chapter Lecture Series” featuring Lecture by Prof. Jayant Haritsa, Department of Computational & Data Sciences, Indian Institute of Science, Bangalore on “The Latent Power of Absurd Ideas (aka Robust Query Processing)” was held on 27th July 2022. The talk presented a first-ever provably robust database engine and was simultaneously streamed on YouTube (<https://youtu.be/gK5PQt8fwpI>) for the benefit of a wider audience including fraternities from technical institutes in Karnataka and CFTIs.

15th “SAMVAAD Talk on 24th August 2022

15th SAMVAAD Lecture (IIT Dharwad-INAE Bangalore Chapter Lecture Series) featuring Lecture by Prof. R.K. Shevgaonkar, FNAE, on “Engineering Education: Past, Present and Future” was held on 24th August 2022. Prof. R.K. Shevgaonkar presented an overview of engineering education from past to present and gave a glimpse of probable future education. For benefit of wider audience, the talk was live-streamed on YouTube (<https://youtu.be/6mkcCkelfQ4>).

16th “SAMVAAD Talk on 28th September 2022

16th SAMVAAD Lecture (IIT Dharwad-INAE Bangalore Chapter Lecture Series) featuring Lecture by Prof. Vijay Chandru, FNAE on “From Digital to Living Machines: Technological Reimagination of Our Future” was held on 28th September 2022.

INAE Chennai Local Chapter

Talk on “Hydrogen Production through Methane Pyrolysis: An alternate approach for Zero carbon” on 13th April 2022

A talk on “Hydrogen Production through Methane Pyrolysis: An alternate approach for Zero carbon” was organized on 13th April 2022 under the umbrella of the IIT Madras, INAE Chennai Chapter, and the IEEE PES Madras Section in Department of Electrical Engineering. The said Talk was delivered by Mr. Bharathi Raja, Research Scholar who was Winner of second Prize in New generation ideation contest 2021 organized by Hindustan Petroleum Green R&D center, Bangalore.

National Conference on Energy Technologies (NCET-2022) on 29th - 30th April 2022

Indian Institute of Technology Madras partnered with International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Chennai, and INAE Chennai Chapter, to organize the National Conference on Energy Technologies (NCET-2022) on 29th and 30th April 2022. The Conference brought together leading academic scientists, researchers, scholars and industry experts to exchange experiences and research results on all aspects of energy storage systems and technologies including battery, fuel cells, supercapacitors, solar and wind energy.

Delivering the Special Remarks virtually, Dr. Anil Kakodkar, Former Chairman, Atomic Energy Commission of India, spoke about the way forward for energy transition of India from fossil fuels to net-zero. He stressed the role of hydrogen energy and the need for the direct splitting of water into hydrogen through grid-independent systems. He also emphasized the need for ‘Made in India’ solutions to overcome the net-zero target. Addressing the Conference, Prof. V. Kamakoti, Director, IIT Madras, highlighted the need for Grid Security and Data Protection. He stressed the need for energy auditing to save power. He also mentioned the interesting solutions provided by the start-ups and their need in realising the net-zero Atmanirbhar Bharat.

Delivering the keynote address, Prof. Ashok Jhunjhunwala, President, IIT Madras Incubation Cell (IITMIC) and IIT Madras Research Park (IITMRP), presented his analysis on ‘How Soon can India get to Net-Zero.’ He pointed out that the developed countries contribute most to global warming, while India was placed at 103rd in Greenhouse Gas Emissions (GHG). The need for strategies in green technologies with commercial viability supported by exclusive policy intervention was strongly proposed in his talk. Prof. Ashok Jhunjhunwala highlighted the challenges in energy storage even during the availability of abundant solar energy. He gave an overview of calculating the cost per kWh taking into consideration the depreciation and the interest involved.

The topics that were discussed during the two-day National conference include

- Energy Storage Technologies for EVs, stationary applications and strategic sectors
- Hydrogen and Fuel Cell technologies
- Material selection and design for Energy Storage and Conversion
- Process technologies for Recycling and Waste management
- Energy Demand Analysis in Smart Grids and other sectors
- Data Analytics for Renewable Energy Integration
- Artificial Intelligence Applications to Energy storage devices



Prof. Indranil Manna, President, INAE in his speech, emphasized reaching the net-zero energy infrastructure without jeopardizing nature. Prof. Sundararajan, former director of International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), stressed the need for topic-specific meetings within India to quickly achieve disruptive technologies. Prof. Narayanan, INAE President-Chennai Chapter, briefed about the various activities happening at INAE Madras Section which are of national interest. He emphasized the importance of micro-scale energy harvesting such as through vibrations.

Dr. R. Gopalan, Regional Director of ARCI, Chennai Centre, and Prof. R. Sarathi Department of Electrical Engineering made the welcoming remarks, highlighting the focus of the conference. They emphasized the importance of interdisciplinary research in realizing green technologies. As many as 14 eminent scientists/academics/industry experts delivered lectures during the conference covering the spectrum of energy technologies along with 36 oral presentations by researchers. Four best oral presenters were awarded certificates and prizes. The Two days event ended with a vote of thanks by Prof. Nandita DasGupta, Secretary INAE Chennai Chapter. She concluded the event by stating that it was brainstorming with young minds and researchers working on energy technologies and would form a pathway to achieving Net-Zero.

Webinar on “Towards an Atmanirbhar Telecom Network” on 8th July 2022

INAE Chennai Chapter Webinar featuring Lecture by Prof. Bhaskar Ramamurthi, FNAE, Dept. of Electrical Engineering, IIT Madras on “Towards an Atmanirbhar Telecom Network” was held on 8th July 2022. About 20 people attended the webinar. Prof. S. Narayanan introduced the speaker. In this webinar, the speaker described how India is moving towards the goal of a secure Atmanirbhar 4G and 5G telecom network. He said that even though India’s telecom network and subscriber base has grown by leaps and bounds during the last two decades, positively impacting the lives of all Indians, this has been achieved mostly by the imported network equipment and mobile phones. However, India, the world’s second largest telecom market, has to become a net contributor to global telecommunication technology and cannot remain a mere assembler and consumer. Design-led manufacturing of globally competitive products based on home-grown IP is the key to meeting this objective. Prof. Ramamurthi discussed how India is moving towards this objective. There was a lively discussion at the end of the webinar. Finally, Prof. Shaikh Faruque Ali presented the vote of thanks.

Webinar on “Human Heart: An Engineer’s Delight and a Clinician’s nightmare” on 20th August 2022

INAE Chennai Chapter Webinar by Prof. R. Krishnakumar, Institute Professor, Engineering Design Department, IIT Madras on “Human Heart: An Engineer’s Delight and a Clinician’s nightmare” was held on 20th August 2022. More than 30 people attended the webinar which also included a number of medical professionals. Prof. S. Narayanan, President of INAE Chennai Chapter presented briefly the activities of INAE Chennai Chapter and introduced the speaker. In this webinar, the speaker described how engineering can help in understanding the functioning of complex bio-organs with particular emphasis on the human heart. He explained how the human heart was often considered to be an engineer’s delight because of the complexities involved in modelling its material characteristics and it’s functioning and also mimicking the same in the laboratory environment for doing meaningful experiments which would help the doctor in diagnosis and treatment of heart diseases. At the same time, he also explained how the heart was a clinician’s nightmare being one of the most vital organs of the human body, the preservation of whose good health is of utmost importance for human life.

In his lecture, he said one in four deaths reported in India was due to cardiovascular diseases (CVD) and that South Asians accounted for one-fifth of all deaths attributed to a coronary artery disease. He explained how the heart was made up of composite materials and essentially was a composite structure with fibers

running in opposite directions in a helical fashion inside and outside of the heart. He also explained how the electrical and the mechanical bio interactions elongate these fibers resulting in a twist. This torsion of the heart is responsible for ejection of blood rather than the pumping action of the heart which is the common belief. He also said how this action caused pulsations resulting in wave propagation. He said that the governing equation for such motion can be derived and solved using finite volume technique. He said that it was possible to create a heart model with the complete arterial and venous tree to create a digital twin of a patient. He said such “what if” parametric studies could help clinicians in taking informed decisions, whether it was the angle of attachment of an outflow graft in an LVAD or the site of attachment of a conduit in a Fontan operation improving very much, the chances of prognosis.

He emphasized that the future of simulation lay in developing robust patient-specific models of the heart, the complete arterial and venous tree, and the pulmonary vascular system. Modelling of electrophysiology of the heart and a three-way coupling with fluid and solid is a great challenge. The Center for Drug Evaluation and Research (CDER) of the Food and Drug Administration (FDA) of USA is currently using modeling and simulation to predict clinical outcomes. Unravelling the complexities of the human cardiovascular system is a work in progress across several centuries and countries and he said modern engineering tools could help immensely in the process. He said that digital twins mentioned earlier of human organs could help in deciding health of the organ, what type of treatment to be used and what would be the possible outcome of the treatment. Studies on simulation allowed one to enter clinical problem-specific or patient specific variables in the model and then test the various therapeutic options. He mentioned that thus clinicians were frequently looking for engineering solutions to better understand and solve difficult problems in the domain of blood flow, imaging and perhaps in developing newer artificial devices. He said that the future lay in progress of medical fraternity and engineering fraternity to work together holding hands for developing a healthy society. There was a lively discussion at the end of the webinar with a Question and Answer(Q&A) session in which both engineers and doctors participated. The webinar was moderated by Prof. Shaikh Faruque Ali, Treasurer, INAE Chennai Chapter who also proposed a formal vote of thanks.

Webinar on “Process Safety and Risk Management with focus on Hydrogen Safety” on 16th September 2022

INAE Chennai Chapter Webinar featuring Lecture by Prof (Dr) Chitra Rajagopal, Director, Centre of Excellence in Process Safety and Risk Management for a Hydrogen Economy, IIT Delhi on “Process Safety and Risk Management with focus on Hydrogen Safety” was held on 16th September 2022. In this talk, Dr. Chitra Rajagopal talked about the various issues and safety hazards associated with Hydrogen storage and transport. She also outlined a complete plan for safe hydrogen economy. The talk included illustrative case studies for use of advanced tools in hydrogen safety assessment as well as training of industry and emergency response personnel. About 40 people joined the webinar on-line. Prof. S. Narayanan, President INAE Chennai Chapter introduced the speaker. The vote of thanks was proposed by Prof. Nandita DasGupta, Secretary, INAE Chennai Chapter.

Webinar on “Education and Research in Emerging and Disruptive Technologies in HEIs” on 25th November 2022

Webinar by INAE Chennai Chapter was held on 25th November 2022 on “Education and Research in Emerging and Disruptive Technologies in HEIs” by Prof Kamakoti Veezhinathan, Director, Indian Institute of Technology Madras. In this talk, Prof. Kamakoti talked about the need for accessibility to world-class education by a larger section of the society. He pointed out that various IITs are working towards different online programs, so that students from anywhere in the country can register for these courses and upskill. He mentioned that IIT Madras had launched an online 4-year Bachelor of Science program in Data Science and Applications, which is the first of its kind in the world. Several such online courses are being planned and will



be launched in near future. About 40 people joined the webinar on-line. Prof. S. Narayanan, president INAE Chennai Chapter introduced the speaker. The vote of thanks was proposed by Prof. Nandita DasGupta, Secretary, INAE Chennai Chapter.

Webinar on “Rethinking the Idea of a University” on 22nd December 2022

Webinar by INAE Chennai Chapter was held on 22nd December 2022 on “Rethinking the Idea of a University” by Prof. MS Ananth, Former Director, IIT Madras. This was held in hybrid mode with about 30 people joining online and another 25 in person. In this talk, Prof. Ananth talked about the challenges faced by the universities and the need for reaching out to a larger number of students. In this context, he mentioned the important role played by NPTEL (National Programme on Technology Enhanced Learning), which has benefitted a large number of students who can freely access the lectures by experienced professors. He also talked about the importance of Industry-academia interaction and discussed how the Research Park was set up adjacent to IIT Madras to promote such interaction. The talk was followed by a lively discussion with members of the audience both on and off-line. Prof. S. Narayanan, President INAE Chennai Chapter introduced the speaker. The vote of thanks was proposed by Prof. Nandita DasGupta, Secretary, INAE Chennai Chapter.

Webinar on “Character in Globalization: Retaining dignity and individuality in a not so flat world of free-market and globalization” on 28th January 2023

Webinar by INAE Chennai Chapter on 28th January 2023 on “Character in Globalization: Retaining dignity and individuality in a not so flat world of free-market and globalization” by Dr. Sathya Prasad Mangalaramanan, FNAE, Senior Vice President, Ashok Leyland, Chennai. The Abstract and Speaker’s bio of the lecture are given below.

Abstract: There is a way to cultivate character and dignity in a not-so-flat capitalistic world of globalization and free-market. This lecture tried to address a broader theme on how to retain individuality in an uncompromising, capitalistic, market-driven society where the common denominator boils down to only money and nothing else. One of the terms around which such capitalistic structures are built is “agility”. The speaker did a bit of search outside on this oft misused term. After spending considerable time, the speaker came to a realization about the futility of searching outside and hence started searching inside. The fascinating outcome of such an inner soul-searching offered a better and more complete meaning to the term agility, and through it helped the author understand that such a meaning would help aspirants bridge the widening gap between existential compulsions that annihilate individuality and the need to come to terms with oneself in order to retain individuality. It helps one to realize that the fast-paced societal forces pulling on one side must be balanced by an equally potent force that is called individuality on the other side. While the former demands agility, there is a need to balance it with stability, for the sake of the latter. This presentation is about the unspoken and oft avoided term “stability” and the investigation of how agility and stability are both inextricably braided to each other.

Speaker’s Bio: Dr. M Sathya Prasad has been with Ashok Leyland since 2004 and is now a Senior Vice President and Chief Engineer in charge of Bus, International Operations, and Defence businesses. He had also headed various engineering functions in AL’s Product Development in the past. From 2000 to 2004 he was with Dana Corporation, USA where he was the Senior Principal Engineer, Advanced Products, and Lead CAE Specialist. From 1997 to 2000, he served as a Design Engineer, Nuclear Engineering, at Babcock & Wilcox Canada. His first stint with industry was with Larsen & Toubro where he was employed as a Marketing and Application Engineer for earthmoving machinery between 1990-92. Dr. Sathya Prasad



holds a Ph.D. in Mechanical Engineering from Memorial University, Canada, in 1997, where he received the Governor General's Academic Gold medal for the best doctoral thesis. His MS was from the University of Regina, Canada, in 1993, with great distinction. He did his undergraduate from the College of Engineering Guindy, in 1990 and was ranked third among the 120 graduating students from the Mechanical Engineering department. Dr. Sathya Prasad is a Fellow of the Indian National Academy of Engineers. He has 22 patents granted, around 16 journals, and more than 30 conference publications.

Webinar on “Atmanirbhar Bharat through Reforms in Engineering Education” on 25th March 2023

A Webinar was organized by INAE Chennai Chapter on 25th March 2023 on “Atmanirbhar Bharat through Reforms in Engineering Education” by Prof. B.S. Murty, Director, Indian Institute of Technology Hyderabad.

INAE Mumbai Local Chapter

Lecture on “Computational Fluid Dynamics for Academia and Industries” on 17th May 2022

The INAE Mumbai Chapter organized first lecture of the lecture series at BARC Mumbai on 17th May 2022, which was delivered by Prof. Atul Sharma, Professor, Mechanical Department, IIT Bombay in a hybrid mode. The title of the said lecture was “Computational Fluid Dynamics for Academia and Industries”. The programme of the lecture started with a one-hour interaction with the students (M.Tech/PhDs) of Homi Bhabha National Institute (HBNI) Mumbai, which was moderated by Dr RB Grover, FNAE, Emeritus Professor HBNI; Dr R. K. Singh, FNAE, Co-Convenor INAE Mumbai Chapter and Senior Professor HBNI; and Dr. Archana Sharma, FNAE, Secretary INAE Mumbai Chapter and Outstanding Scientist BARC. The interaction session was followed by a lecture on “Computational Fluid Dynamics (CFD) for Academia and Industries” by Dr Atul Sharma, FNAE, Professor IIT Bombay. The lecture was delivered on a hybrid-mode, which was attended in-person by the scientists of BARC and students of HBNI; and also, by the online participants via INAE platform. The lecture began with a welcome address by Dr R. K. Singh followed by introduction of the speaker by Dr. S. V. Kulkarni, FNAE, Co-Convenor INAE Mumbai Chapter and Professor IIT Bombay.

Prof. Sharma demonstrated CFD as a powerful tool for physics-based simulations and big-data analysis of various fluid flow and heat transfer problems in academic as well as industrial research and development. For academic research, he presented a physical law-based finite volume method (FVM) on CFD development while CFD application and analysis are presented for two types of problems: first, four different studies on various types of fish-like unified-kinematics, adaptive-kinematics, continuous-vs-intermittent swimming, and batoid fish-like swimming of a 2D and 3D hydrofoil; and second, flow induced coupled-vibrations of an elastically-mounted cylinder and a detached flexible plate. Further, CFD application and analysis for industrial applications are presented for thermal-hydraulic characteristics and performance of two engineering systems: first, horizontal versus vertical fan-flow across a radiator in a power transformer; and second, three different studies on 3D printed circuit heat exchanger (PCHE)—used as a recuperator in International Thermonuclear experimental reactor (ITER). The seminar was covered with numerous fluid-dynamic movies for the above problems in academia and industries. In questionnaire session, the participants discussed a few pertinent aspects of CFD development, application, and analysis such as relevance of physical law based FVM, flow physics for the flow-induced vibrations, and the bonding of the plates in the PCHE. The Secretary, INAE Mumbai Chapter, thanked the speaker for his outstanding lecture, participants, organizing team at HBNI, and INAE team for the support and making this event successful.



Webinar on “Entrepreneurship: To Be or Not to Be” on 1st July 2022

As per the new initiatives of INAE Mumbai Local Chapter an informal meeting was arranged at NITIE, Mumbai on July 01, 2022 between the guest speaker Dr. Anuradha Narasimhan, Professor of Practice at IIT Bombay and Board Member – Africa Improved Foods, Rwanda and Frontier Nutrition, Bangladesh with students and faculty members from NITIE who delivered a talk on “Entrepreneurship: To Be or Not to Be”. After the talk, the discussions covered a wide range of topics related to academics and research work being pursued at NITIE on entrepreneurship and various concurrent issues and challenges. The students presented their research problems and suitable guidelines were provided by Dr. Anuradha Narasimhan.



Audience during the INAE Mumbai Local Chapter Lecture

In the webinar, entrepreneurship and its relevance in the present-day context was highlighted by the speaker. The basic guidelines for an entrepreneur and the fundamental concepts of entrepreneurship, opportunity identification, customer discovery, customer value proposition, marketing and Go-to-Market strategy were highlighted by the speaker. The talk provided a bird’s eye overview to the students and aspiring entrepreneurs. With a strong background in industry and academia, the eminent expert Prof Anuradha Narasimhan touched upon concurrent topics with many real-life examples of aspiring entrepreneurs and start-ups from industry and academia. Several of these could achieve the status of unicorns with one billion plus turnover very rapidly.

The program ended with a networking session in which a meeting was arranged between Director NITIE, NITIE faculty members, the Guest Speaker, Dr. Anuradha Narasimhan and INAE Mumbai Local Chapter co-chairs, Prof. Ram Kumar Singh and Prof SV Kulkarni and the Secretary, Prof. Archana Sharma. It was decided that IIT Bombay and NITIE may initiate collaboration focussing on topics of mutual interest that are also of relevance to the industry. It was also decided that apart from initiatives for motivating students and faculty members, the INAE Mumbai Local Chapter would make endeavours for more active participation of research institutes and industry.



Pictorial Glimpses of the INAE Mumbai
Local Chapter Lecture

Pictorial Glimpses of the INAE Mumbai
Local Chapter Lecture

DAE-BRNS Theme Meeting on “Advance Technologies in Dissimilar Metal Welding (DMW-2022) & DAE Technology Awareness Meet-II” on 15th-16th July 2022

A DAE-BRNS Theme Meeting on “Advance Technologies in Dissimilar Metal Welding (DMW-2022) & DAE Technology Awareness Meet-II” was organized and conducted jointly by Bhabha Atomic Research Center, Mumbai, INAE, Mumbai Chapter and Power Beam Society of India (PSI) during 15th and 16th July 2022 at DAE Convention Centre, Mumbai. The theme meeting was organized in hybrid mode i.e. physical mode for local delegates and online mode for outstation delegates. The theme meeting DMW-2022 offered a common platform to the Engineers, manufacturers and Scientists working in the field of welding and joining technology to churn out the expertise in the field of advanced technologies such as EB Welding, Magnetic Pulse Welding, Diffusion bonding, friction stir welding, which are more suitable for welding dissimilar metals. The theme meeting was inaugurated with an introductory remark by Dr. Archana Sharma, FNAE, Director, BTDG, and Chairperson, DMW-2022 and Presidential Address by Guest of Honour, Shri K. V. Ravi, Chief Executive, Nuclear Recycle Board. Chief Guest of the inaugural session Shri G. Nageswara Rao, Chairman, Atomic Energy Regulatory Board (AERB) addressed the dignitaries and participants of the theme meeting. The souvenir book of abstracts containing the invited talks and contributory papers of DMW-2022 was also released during the inaugural session by the Chief Guest.



Image 1: Release of Theme Meeting Souvenir during DMW-2022

The theme meeting key note address was delivered by Dr. G. K. Dey, Former Director, Materials Group, BARC on “Microstructural Development during welding”. Prof. S. V. Kulkarni, FNAE, Co-Chair, INAE, Mumbai Chapter, IIT Mumbai delivered the opening lecture of the theme meeting on “Electromagnetic Forming and Welding: Insights into Electromagnetic Forces, Eddy Currents, and Computational Methods”. The technical programme included 18 invited talks from eminent speakers from IITs, DAE Units and entrepreneurs highlighting the ongoing research, challenges and future prospects in dissimilar metal welding. DMW-2022 was attended by 150 participants and the technical talks were broadcast live on <https://www.dmw2022.com> website. The contributions from participants of DAE and other academic institutes were covered in the Poster session. The two days theme meeting concluded with panel discussion and valedictory function. Dr. Ram Kumar Singh, FNAE, Co-Chair, Mumbai Local chapter addressed the dignitaries and participants in the concluding session and distributed the prize to the winners of DMW-2022 Best Poster Paper Award.



Prize distribution for DMW-2022 best Poster Paper Award

Discussion meeting on ‘Rare Earth - Plethora of Opportunities’ on August 11, 2022

A virtual discussion meeting on ‘Rare Earth - Plethora of Opportunities’ was held on August 11, 2022 over WebEx. The objective of this meeting was to deliberate on opportunities and challenges in this sector and how INAE can contribute towards this initiative. During the subject discussion meeting, a talk by Mr. Deependra Singh, Chairman and Managing Director, IREL (India) Limited, Department of Atomic Energy, Govt. of India was held followed by a discussion with experts. The session was chaired by Prof Indranil Manna, Co-Chair, DAE-INAE Consultative Committee & President, INAE.

Webinar on “Indigenous Electron Beam Accelerators for Agriculture and Industries” on September 12, 2022

INAE Mumbai Chapter organized a half day webinar on “Indigenous Electron Beam Accelerators for Agriculture and Industries” in association with BARC on September 12, 2022. It was held in hybrid mode (online and offline both) at Electron Beam Centre (EBC), Kharghar, Navi Mumbai, a BARC facility. Dr. Ram Kumar Singh, FNAE, Former Associate Director RDDG, BARC chaired the webinar and introduced the speaker. Mr. Shrikrishna Gupta, Raja Ramanna Fellow, DAE; Former Outstanding Scientist, BARC; Former OSD, DAE Branch Secretariat, New Delhi and Former Project Director,



Global Centre for Nuclear Energy Partnership (GCNEP), Bahadurgarh, Haryana delivered a talk during the said webinar. Mr. Gupta explained in detailed about potential application of electron beam (EB) for improvement in switching performance of semiconductors, cross linking of polymers, sterilization of medical products etc. The application of EB to preserve food commodities, enhancing the shelf life of grains, pulses, onion, fruits etc, development of new varieties of crops by seed mutations and bio-stimulators for agriculture applications are highlighted. Followed by Mr. Gupta’s presentation, a visit to electron accelerator facility was organized for attendees along with demonstration of different agriculture products developed with EB at EBC, Kharghar. Many scientists from BARC, agriculture institutes, retired scientists, personnel from industries and students were attended the webinar. During his concluding remark Sh. P. C. Saroj, Project Manager EBC thanked all the participants.

Webinar on “Chemical Parks in India: Sparking a Game changer” on 31st January 2023

A Webinar was organized by INAE Mumbai Chapter on 31st January 2023 on “Chemical Parks in India: Sparking a Game changer” by Shri Rajeev Pandia, FNAE, Former President, Indian Chemical Council. The moderator was Prof. AK Suresh, FINAE, Emeritus Fellow, Department of Chemical Engineering, IIT Bombay. The Abstract and Speaker’s bio of the lecture are given below.

Abstract: The competitiveness and growth of the Indian chemical industry have consistently lagged behind those of its major global counterparts. A major reason is lack of adequate infrastructure. While dedicated Chemical Parks have become the norm elsewhere to support the industry, attempts to create them have failed repeatedly in India. The talk focused on current gaps in infrastructure, concept of a chemical park,



the contribution well-conceived chemical parks can make to the future of the Indian chemical industry and directional changes needed in policy initiatives.

Speaker's bio: Shri Rajeev Pandia is a graduate in Chemical Engineering from Indian Institute of Technology (IIT) Bombay and holds the Master's degree in the same field from Stanford University, California. During his career spanning 50 years, he has been associated with strategic planning, project evaluation and management, technology transfer, international marketing, safety, health and environmental issues, Government policies and general management. During 2000-2002, he was the President of Indian Chemical Manufacturers Association (now Indian Chemical Council). Mr Pandia headed Herdillia Chemicals Limited (later Schenectady Herdillia Limited and SI Group – India Limited) from 1992 and was its Vice Chairman and Managing Director. A Distinguished Alumnus of IIT Bombay and a Rotary International scholar, he is a Fellow of Indian National Academy of Engineering and of Indian Institute of Chemical Engineers. In 2009, Mr Pandia received the ICC Lifetime Achievement Award from Indian Chemical Council for his contribution to the Indian chemical industry. He is an independent director on the Boards of several well-known chemical companies.

The webinar presented the concept of chemical parks with examples in the global emerging economies. It further emphasized with examples on the present gaps in infrastructure in the Indian context. At present India with 17% of the world population has a mere 3% share in the global chemical industry while China with the same population has 33% share and this is projected to grow to 40% in the 2020s. There is a need for trade production measures in India since our imports are growing at a faster pace as compared to the exports. Examples were cited about Korea and Thailand where phenomenal progress was achieved using the Chemical Park concept. The scenario in India clearly highlights a lack of strategic planning.

The talk highlighted the need for suitable development of feedstock, power/water, and steam resources, and facilities such as, pipeline corridor, wastewater treatment, solid waste disposal, and transport infrastructure with good roads, rail tracks and river/sea routes. Development of a large number of chemical ports along the coastal regions was suggested for improving the transport infrastructure. Human resource and skill development, and R&D lab facilities around the chemical parks were also recommended. Examples of chemical parks that promoted phenomenal growth in various countries were cited during the webinar, including the Jurong-1.0 chemical park in Singapore, Rotterdam chemical park in Netherland, Belgium, France, Germany and Italy, Shanghai chemical park in China and South Korean chemical parks. Development of the Jurong-2.0 chemical park (Singapore) focussing on futuristic technologies with low carbon emission, and technologies with provision for carbon capture and chemical recycling were elaborated. In the Indian context the need for developing free quality stock, PPP growth models with emphasis on quality (abandoning the L1 concept) was emphasized. It was suggested that resurrection is still possible with suitable policy interventions and corrective steps. Implementation of circular economy concepts and introduction of hydrogen fuel as announced by the Indian Government are some of the approaches that can provide an impetus for development of cost effective and environment friendly technologies. The webinar talk was well conceived, and it was concluded that chemical parks can meet the future challenges of the Indian chemical industry and policy interventions can have a beneficial effect. The experts suggested organizing an INAE Conclave on Chemical Parks where various issues can be addressed and recommendations may be made to the Indian Government.

INAE Women's Day Celebration on "Women contributions in Engineering and Technology" on 11th March 2023

INAE Women's Day Celebration talk at Electron Beam Centre, Navi Mumbai March 11, 2023. Talks were held by INAE Mumbai Chapter on the theme "Women contributions in Engineering and Technology" on 11th March 2023 - (i) Smt Smitha Manohar, Director NRG, BARC & INAE fellow delivered talk on "Nuclear Fuel Recycling"; (ii) Dr Gopika Vinod, Fellow INAE delivered talk on "Reliability, safety & risk analysis on nuclear & non-nuclear facilities"; (iii) Dr (Smt) K. Umasankari, Head RPDD, BARC delivered talk on "Reactor Design"; and (iv) Smt. Anuradha Sharma, founder member and partner of Chromosome Consulting and IT services delivered talk on "corporate leadership".



INAE Mumbai Local Chapter Women's Day Celebration Lectures in Progress

As per the initiatives of INAE Mumbai Local Chapter, Women's Day 2023 function organised at EBC Navi Mumbai on March 11th 2023, Project Manager, EBC delivered an introduction talk on indigenous electron beam accelerator technologies developed at EBC, BARC. Prof. Archana Sharma, Director BTDG, BARC, introduced the Guest speaker Smt Smitha Manohar, FNAE, Director NRG, BARC to deliver talk on Nuclear Fuel Recycling. Sh. K. Jayrajan, Former Chairman BSC, BARC felicitated Smt Smitha Manohar by giving memento after the talk. Dr Gopika Vinod, FNAE delivered talk on Reliability, safety & risk analysis on nuclear & non-nuclear facilities & was felicitated with memento by Sh. Martin Mascarenhas, Head L&PTD, BARC. Dr (Smt) K. Umasankari, Head RPDD, BARC delivered talk on reactor design and was felicitated with memento by Smt Kavita Dixit, Former Head BSCS, BARC. Smt. Anuradha Sharma, founder member and partner of Chromosome Consulting and IT services gave talk on corporate leadership and was felicitated with memento by Sh. Shrikrishna Gupta, Raja Ramanna Fellow, DAE; Former Outstanding Scientist, BARC; Former OSD, DAE Branch Secretariat, New Delhi and Former Project Director, Global Centre for Nuclear Energy Partnership (GCNEP), Bahadurgarh.

After the presentation, a visit to the electron accelerator facilities was organized for the attendees of the function for RF Linac (10 MeV, 3/5 kW) used for social & industrial applications and DC Accelerator used for environmental applications (wastewater treatment). The attendees appreciated the indigenous efforts after witnessing the demonstration of compact X band RF Linac development for cancer therapy at EBC. The program ended with an interaction, feedback session from the participants, followed by lunch and group photograph.



Group Photograph during INAE Mumbai Local Chapter Women's Day

INAE Hyderabad Local Chapter

Dr. G. Padmanabham Memorial Lecture on “Additive Manufacturing” on 10th August 2022

The first Dr. G. Padmanabham Memorial Lecture was held on 10th August 2022 at 10.30 hrs. G.S. Bhattacharjee Seminar Hall, ARCI, Hyderabad. in hybrid mode to commemorate the valuable contributions of late Dr. G. Padmanabham, Former Director, ARCI in the field of Science and Technology and was a Fellow of INAE. Prof. Indranil Manna, Vice Chancellor, BIT, Mesra delivered the said lecture on “Additive Manufacturing”.

INAE Delhi Local Chapter

Technical Talk on “Artificial Intelligence: Past, Present & Future” on 30th May 2022

INAE Delhi Chapter organized a Technical Talk on “Artificial Intelligence: Past, Present & Future” by Professor Dr Mausam, Founding Head of School of Artificial Intelligence and Professor of Computer Science at Indian Institute of Technology (IIT) Delhi held on Monday, 30th May 2022 at Indian Institute of Technology (IIT) Delhi in a hybrid mode.

Seminar “The Role of Materials Science in Information Processing Technologies” on 13th July 2022.

INAE Delhi Chapter Seminar in association with the School of Interdisciplinary Research (SIRE), IIT Delhi organized a Lecture by Professor Dr Supratik Guha, Professor at the Pritzker School of Molecular Engineering at the University of Chicago and Argonne, National Laboratory, Chicago on “The Role of Materials Science in Information Processing Technologies” on 13th July 2022.

Industry Interaction on “Evolution of Electric Vehicles and Charging Infrastructure in Delhi” on 26th July 2022

INAE Delhi Chapter: Industry Interaction with Mr Rajeev Sapra, Deputy General Manager (DGM) of Delhi Transco Limited (formerly, Delhi Vidyut Board) on “Evolution of Electric Vehicles and Charging Infrastructure in Delhi” was organized on 26th July 2022. Mr Rajeev Sapra gave an expert talk titled “

Evolution of Electric Vehicles and Charging infrastructure in Delhi “ on 26th July 2022 in EE committee room in IIT Delhi as part of industry interaction. The event was jointly organized by IEEE-VTS and INAE. Mr Rajeev Sapra is currently working as Deputy General Manager of Delhi Transco limited. He is one of the leaders in developing the architecture of Electric Vehicles Charging Stations for the entire capital city of Delhi. Mr Sapra stressed in his talk about the aspects of practical engineering rather than academic knowledge. He emphasized the need for students to learn by building things on their own. In this regard, he also shared his experience about how the bidding and technical specifications of chargers for the capital city were decided. He also showed the probable sites of 100 chargers in and around Delhi. The technical specifications of the chargers with 10 charging points were also discussed. The interaction with Mr Sapra was very informal with lot of questions from enthusiastic students. He invited students for a visit to the nearest substation in Munirka for a practical understanding and feel of the transmission system. Apart from this, Prof Sreyam Sinha from department of Electrical Engineering gave a detailed presentation on “Recent trends in wireless charging techniques”. In this talk, he analyzed the inductive and capacitive wireless charging techniques for electric vehicles and made a comparison of them. He also showed the experimental prototype built for capacitive wireless charging taking care of misalignment and variable distance between the road and the chassis.



Photographs of Industry Interaction Session with Mr. Rajeev Sapra at IIT Delhi



There were about 30 graduate students and a few faculty members participated in-person in the interaction. The technical interaction was followed up by a lunch meeting with a few faculty members. The technical interaction was also available to the online participants who could not attend in-person.

Talk on “Spectrum Challenges for Next Generation Wireless Systems: the need for better coexistence” on 27th July 2022

INAE Delhi Chapter Talk by Prof. Monisha Ghosh, Professor of Electrical Engineering, University of Notre Dame, USA and Former Chief Technology Officer, Federal Communications Commission, USA on “Spectrum Challenges for Next Generation Wireless Systems: the need for better coexistence” was held on 27th July 2022. The seminar of Prof. Monisha Ghosh discussed coexistent communication as a tool to meet the increasing communication throughput demands. The various challenges that must be overcome to achieve coexistence in the licensed and unlicensed mid-band spectrum were articulated. The presentation also highlighted the importance of unlicensed spectrum for NextG technologies and the benefits and difficulties of using unlicensed bands for licensed technologies like cellular communication. The talk strongly emphasized the importance of monitoring deployed network performance with AI/ML research and for developing more accurate channel models. The seminar also featured case studies on measurement-based research on 5G millimeter-wave frequency bands (mmWaves), LTE-LAA coexistence in 5 GHz, and other topics. Further, the presentation also covered how the thermal effect makes it difficult to achieve sustained throughput over mm Waves. Additionally, the talk underscored the advantages of deploying 4G+LAA networks over 5G or 4G networks. There were about 44 graduate students and a few faculty members participated in-person in the interaction. There were about 27 online attendees. The technical interaction was preceded by a lunch meeting with the invited speaker with a few faculty members. Beyond the talk and question-answer session, the speaker interacted with a wide set of in-person attendees over a high tea organized in the school.



Seminar on “Strategies for Mitigating Fire Hazard in Critical Transportation Infrastructure” on 27th July 2022

INAE Delhi Chapter Seminar featuring Lecture by Professor Dr Venkatesh Kodur, University Distinguished Professor and Director of the Centre on Structural Fire Engineering and Diagnostics at Michigan State University (MSU) on “Strategies for Mitigating Fire Hazard in Critical Transportation Infrastructure” was held on 27th July 2022.

Seminar on “Interactive Systems using High-Performance Flexible and Printed Electronic Skin” on 10th August 2022

INAE Delhi Chapter Seminar featuring Lecture featuring Talk by Professor Dr Ravinder Dahiya, Professor of Electronics and Nanoengineering and EPSRC Research Fellow in the James Watt School of Engineering at University of Glasgow, UK on “Interactive Systems using High-Performance Flexible and Printed Electronic Skin” was held on 10th August 2022.

Talk on “The Art and Science of Academic Spinouts: A Journey from Water Research Lab to Drumlins Water Technologies” on 29th August 2022

INAE Delhi Chapter Lecture featuring talk by Prof. Dr Suphiya Khan, Associate Professor and Founder of spinout company Drumlins Water Technologies Pvt Ltd at Banasthali Vidyapith on “The Art and Science of Academic Spinouts: A Journey from Water Research Lab to Drumlins Water Technologies” was held on 29th August 2022.

Technical Talk on “Computational Software and the Future of Intelligent Electronics System Design” on October 14, 2022

Technical Talk by INAE Delhi Chapter was organized on October 14, 2022 on “Computational Software and the Future of Intelligent Electronics System Design” by Dr Anirudh Devgan, President and CEO of Cadence Design Systems. Prior to becoming CEO in 2021, he was President of Cadence, before which he served as Executive Vice President and General Manager of the Digital & Signoff and System Verification groups. Prior to joining Cadence in 2012, Dr Devgan was Corporate VP and member of the executive staff at Magma Design Automation, and earlier held management and technical roles at IBM. Dr Devgan is widely recognized as one of the leading authorities in electronic design automation (EDA), and successfully pioneered the application of massively parallel and distributed architectures to create several industry firsts and most impactful products in the areas of SPICE simulation, library characterization, place and route, static timing, power and electromagnetics, among several others. He also drove the first common compiler architecture for emulation and prototyping platforms. Dr Devgan is an IEEE Fellow, has written numerous research papers, and holds 27 US patents. He has won several awards, including the prestigious Phil Kaufman Award for his extensive contributions to EDA as well as the IBM Corporate Award and IEEE McCalla Award. Dr Devgan serves on the boards of the Global Semiconductor Alliance and the Electronic System Design Alliance. Dr Devgan received a Bachelor of Technology Degree in Electrical Engineering from the Indian Institute of Technology (IIT) Delhi, and MS and PhD degrees in electrical and computer engineering from Carnegie Mellon University.

Technical Talk on “Progress in Bioelectronics - from Lab-on-Chip to Lab-on-Things” on 22nd November 2022

Technical Talk by INAE Delhi Chapter was organized on 22nd November 2022 on “Progress in Bioelectronics - from Lab-on-Chip to Lab-on-Things” by Professor Dr Sameer Sonkusale, Professor of Electrical and Computer Engineering at the Tufts University in the USA with a joint appointment in the department of Biomedical Engineering and also the department of Chemical and Biological Engineering.

Abstract: Spurred by advances in microfabrication, lab-on-chip technologies have revolutionized our study of biology and life sciences and have resulted in the development of point of care diagnostics. In this talk he looked at some of the advances in this field with a vision towards the future, all through the lens of speaker’s own work. This vision is to migrate from developing lab-on-chip technologies towards lab-on things. Examples discussed in this talk were: (1) Flexible smart bandages for monitoring and treating



chronic wounds, (2) Functionalized smart threads for tissue-embedded or on-skin diagnostics, (3) Ingestible smart pills for studying the gut microbiome, and (4) CMOS-based single cell engineering. The key theme that permeates through all the projects was the embedding intelligence and adding multi functionality into common things. This was made possible due to advances in flexible electronics for realization of truly conformal and flexible sensors and actuators and leveraging the large-scale integration of silicon CMOS-based electronics for instrumentation.

Biography of Speaker: Professor Dr Sameer Sonkusale is currently a Professor of Electrical and Computer Engineering at the Tufts University in the USA with a joint appointment in the Department of Biomedical Engineering and also the Department of Chemical and Biological Engineering. He also held a visiting appointment at the Wyss Institute at Harvard University and at Brigham and Women's Hospital of the Harvard Medical School for 2011-2012 and 2018-2019. For 2012-2013 Prof. Sonkusale was also the Associate Dean of Graduate Education in the School of Engineering at the Tufts University. Currently, Prof. Sonkusale directs an interdisciplinary research group "Nano Lab" with research focus on biomedical micro devices circuits and systems, flexible bioelectronics, point of care diagnostics, precision medicine and CMOS-based instrumentation. The technologies developed in his labs have been licensed to several companies and have resulted in creation of several startups. Several national and international media (Forbes, Economist, Wall Street Journal, STAT News, Fast Company, Telegraph UK, National Public Radio-NPR, BBC Radio, WBUR radio, ABC News-TV, IEEE Spectrum, etc.) have highlighted his work extensively. Prof. Sonkusale received his MS and PhD degrees in Electrical Engineering from the University of Pennsylvania, USA. He has received several awards including the National Science Foundation CAREER Award in 2010. He also received the Acorn Innovation Award from Massachusetts Technology Transfer Office in 2018. He is an alumnus of the National Academy of Engineering US Frontiers of Engineering meeting in 2015, and the National Academy of Sciences Arab-America Frontiers meeting in 2014 and 2016. He also recently received the Distinguished Alumnus award from his alma mater, BITS Pilani. Prof. Sonkusale is on the editorial boards of Scientific Reports (Nature Publishing Group), IEEE Transactions on Biomedical Circuits and Systems, Journal of Low Power Electronics and Application, Chips, PLoS One, and Electronic Letters. He is a Senior Member of the IEEE, and a member of OSA, MRS, BMES and AAAS.

Technical Talks on (i) "Who protects the Unprotected? ITS Services for Vulnerable Road Users" and (ii) "Deployment and Management of Edge Microservices" on January 2, 2023

Two Technical Talks by INAE Delhi Chapter viz., (i) Talk on "Who protects the Unprotected? ITS Services for Vulnerable Road Users" by Professor Claudio Casetti, Professor at Department of Control and Computer Engineering, Politecnico di Torino, Italy; and (ii) Talk on "Deployment and Management of Edge Microservices" by Prof. Carla Fabiana Chiasserini, Professor at Politecnico di Torino, Italy, and a Research Associate with the Italian National Research Council (CNR) and the National Inter-University Consortium for Telecommunications (CNIT) jointly organized by INAE Delhi Chapter in association with Bharti School of Telecommunication Technology and Management, IIT Delhi and IEEE Vehicular Technology Society (VTS) Delhi Chapter on January 2, 2023.

Two Technical Talks by INAE Delhi Chapter on January 2, 2023

I. Topic: "Who protects the Unprotected? ITS Services for Vulnerable Road Users" by Prof Claudio Casetti

Abstract: In this talk he defined what is a Vulnerable Road User (VRU) from the point of view of many international standardisation entities. He then discussed four possible approaches for Intelligent Transport Systems (ITS) to protect VRUs, presenting practical solutions and highlighting pros and cons. First, the use

of smart infrastructure with V2X capability. Then, cooperative perception by vehicles, followed by VRU-awareness messages sent by VRUs themselves. Finally, he discussed the use of edge/cloud support and introduced some open research questions.

Speaker's Bio: Claudio Casetti is a Full Professor at the Department of Control and Computer Engineering, Politecnico di Torino, Italy. He has published over 250 papers in peer-refereed international journals and conferences on the following topics: vehicular networks, 5G networks, transport and network protocols in wired networks, IEEE 802.11 WLAN. According to Google Scholar, his H-index is 41. A list of Claudio Casetti's publications can be found on the Publication Open Repository of Politecnico di Torino. He is a Senior Member of IEEE. He was the Scientific Coordinator of the Master in "Electrified and Connected Vehicle" at Politecnico di Torino between 2018 and 2021. He chaired the Turin Urban Digital Mobility working group within the Smart Roads project fostered by the City of Turin between 2018 and 2022. He has given Tutorials on vehicular networks at major IEEE Conferences, including IEEE ICC, IEEE Globecom, IEEE CCNC and IEEE VTC. He has served in the Technical Program Committees of the main international conferences in the networking field (such as IEEE INFOCOM, ACM SIGMETRICS, IEEE GLOBECOM or IEEE ICC). He is Senior Editor for Mobile Radio of IEEE Vehicular Technology Magazine.

II. Topic: "Deployment and Management of Edge Microservices" by Prof Carla-Fabiana Chiasserini

Abstract: Edge computing is an emerging technology for present and next generation mobile networks, which, unlike the cloud, can meet the low latency or bandwidth consumption requirements of time- and mission-critical services. One essential component of edge computing is service virtualization, with each service being often defined as a set of virtual functions implemented through containers. This talk introduced the main scientific challenges in microservice deployment and management at the edge, including microservice interference avoidance, migration, and retention. Specifically, interference among microservices arises whenever the associated containers run on the same server and, hence, compete for memory resources, even if they are allocated dedicated cores. Such interference can lead to severe throughput degradation, thus harming the microservices performance. Microservice migration is instead pivotal to continuously meeting low-latency requirements, as users or devices move from one access point to another. Characterizing container migration is therefore critical for guaranteeing that the expected QoE is ensured, while minimizing the migration cost for the system. Finally, microservice retention becomes relevant in the presence of serverless computing platforms that can launch multiple isolated containers to fulfil service requests by mobile users. The creation of a new container implementing a microservice may require fetching the corresponding image from the remote repository and fetching and loading essential libraries and dependencies before executing the actual function. This long delay involved in the initialization setup is known as cold-start latency, which represents one of the main performance issues faced by the serverless computing platforms. Reducing the cold-start latency is a hard task due to the infrequent function invocations and their unpredictable patterns. For each of these aspects, she presented possible approaches and solutions, providing interesting insights obtained through experimental measurements, as well as highlighting how such aspects can be conveniently modelled.

Speaker's Bio: Carla Fabiana Chiasserini is a Professor at Politecnico di Torino, Italy, and a Research Associate with the Italian National Research Council (CNR) and the National Inter-University Consortium for Telecommunications (CNIT). She was a Visiting Researcher at UC San Diego (1998-2003), and a Visiting Professor at Monash University (2012 and 2016) and at the Berlin Technische Universität (2021 and 2022). She is a Fellow of the IEEE and a Senior Member of ACM. Her research interests include NextG Networks, Edge Computing, Networking for Machine Learning, and Connected Vehicles. She has published over 350



journal articles and referred conference papers, and she has received several awards for her scientific work. Currently, she serves as Editor-in-Chief of the Computer Communications journal and as Editor-at-Large of the IEEE/ACM Transactions on Networking. Carla is also a member of the Steering Committee of the IEEE Transactions on Network Science and Engineering and of the ACM Mobihoc conference. She has served for several years on the Editorial Board of such journals as the IEEE Transactions on Wireless Networks and the IEEE Transactions on Mobile Computing, and she has been Co-Guest Editor of a number of journal special issues. Carla is/has been involved in many national and international research projects, either as a coordinator or a PI.

Lecture on “Cross-Sector Infrastructure Sharing: Synergy Between Telecom, Transport and Energy Sector” on 17th January 2023

A lecture was organized by INAE Delhi Chapter jointly with Bharti School of Telecommunication Technology and Management, IIT Delhi, IEEE Vehicular Technology Society (VTS) Delhi Chapter and IEEE Comm Society on 17th January 2023 on “Cross-Sector Infrastructure Sharing: Synergy Between Telecom, Transport and Energy Sector” by Mr. Rajendra Singh, Senior Digital development Specialist, The World Bank. The Abstract and Speaker’s bio of the lecture are given below.

Abstract: Digital technology is playing very important role in development of various sectors. The lecture focused on synergy between telecom, transport, and energy sectors. On one hand Smart Electricity Grid and Intelligent Transport System (ITS) need affordable, reliable, and secure telecom system, at the same time transport and energy sectors can help in reducing the cost of telecom system and improving its overall reliability. Depending upon the interest of audience, he covered technical, policy, regulatory, and management aspects of this subject.

Speaker’s Bio: Mr. Singh has 42 years of experience in digital development sector. Currently working as Senior Digital Development Specialist, Global Digital Development Department, The World Bank, Washington DC for past 16 years. He has experience of working in telecom sector in more than 50 countries in all continents including FCV countries like Afghanistan, Iraq, West Bank, and Myanmar. Implemented the World Bank funded digital development projects worth \$ 500 Mn and provided technical assistance on technical, policy and regulatory issues in telecom sector to various governments and regulators. Before joining The World Bank Mr. Singh worked as Secretary, Telecom Regulatory Authority of India (TRAI) and Head, Mobile Network Division, TRAI for seven years. Mr. Singh worked with Indian Railways for about 18 years in different capacities including Director (Telecom). He had a brief experience of about two years with UP State Electronics Development Corporation (UPTRON) and Bharat Electronics, Ministry of Defense undertaking. Areas of interest are 5G, spectrum management, cross-sector synergy between transport, energy, and telecom sectors and Digital Economy. Mr. Singh has lectured in more than 100 national and international conferences, universities in India and abroad. He did M.B.A from FMS, University of Delhi, M.Tech and B.Tech in Electronics and Communication Engineering from I.I.T. Delhi and I.I.T. Roorkee, respectively. He is a Senior Member of IEEE, a Fellow of IET, and a Fellow of IETE.

Seminar on “Advanced Packaging: Chiplets, Dielets, and Heterogeneous Integration” on 17th February 2023

A Seminar was organized by INAE Delhi Chapter on 17th February 2023 on “Advanced Packaging: Chiplets, Dielets, and Heterogeneous Integration” by Professor Dr Subramanian S. Iyer, Distinguished Professor and Charles P. Reames Endowed Chair in the Electrical Engineering Department and a joint appointment in the Materials Science and Engineering Department at the University of California at Los Angeles (UCLA). He is Director of the Center for Heterogeneous Integration and Performance Scaling (UCLA CHIPS). The Abstract and Speaker’s bio of the lecture are given below.

Abstract: Packaging is undergoing a major paradigm shift and promises to take up the lag caused by the slowing down of CMOS scaling. He examined these shifts that have been driven by the scaling of key packaging metrics such as bump pitch, trace pitch, inter-die spacing and alignment. The goal of advanced packaging was to enable the same benefits that Moore/Dennard scaling has accomplished for CMOS viz. density, performance, power, and cost and can make packaged chip assemblies comparable to monolithic SoCs using these metrics with the additional advantage of heterogeneity. The vehicles that advanced packaging employs are somewhat different: dielets/chiplets, advanced assembly techniques, simplified inter-chip communication protocols and cost optimization via the use of optimized heterogeneous technologies. Another important aspect of advanced packaging is the adoption and adaptation of silicon technology methods to packaging. In this talk he discussed the technologies and some instantiation examples that we have developed at UCLA.

Speaker's Bio: Subramanian S. Iyer is Distinguished Professor and holds the Charles P. Reames Endowed Chair in the Electrical Engineering Department and a joint appointment in the Materials Science and Engineering Department at the University of California at Los Angeles (UCLA). He is Director of the Center for Heterogeneous Integration and Performance Scaling (UCLA CHIPS). Prior to that he was an IBM Fellow. His key technical contributions have been the development of the world's first SiGe base HBT, Salicide, electrical fuses, embedded DRAM and 45nm technology node used to make the first generation of truly low power portable devices as well as the first commercial interposer and 3D integrated products. He has been exploring new packaging paradigms and device innovations that may enable wafer-scale architectures, in-memory analog compute and medical engineering applications. He is a fellow of IEEE, APS, iMAPS and NAI as well as a Distinguished Lecturer of IEEE EDS and EPS. He is on the Board of Governors of IEEE EPS. He is a Distinguished Alumnus of IIT Bombay and received the IEEE Daniel Noble Medal for emerging technologies in 2012 and the 2020 iMAPS Daniel C. Hughes Jr Memorial award and the iMAPS distinguished educator award in 2021. Prof. Iyer is currently Prof. Ramakrishna Rao Visiting Chair Professor at CeNSE, IISc, Bengaluru.

Seminar on “Resilience of Structures and Infrastructure under Extreme Transient Loads” on 24th March 2023

A Seminar was organized by INAE Delhi Chapter on 24th March 2023 on “Resilience of Structures and Infrastructure under Extreme Transient Loads” by Prof. Dr Adnan Ibrahimbegovic, Professor Classe Exceptionnelle, Member Senior IUF-Institut Universitaire of France and Chair for Computational Mechanics at University of Technology Compiegne, a member of Alliance of Sorbonne Universite (created with merger of Paris-Sorbonne and Universite Pierre Marie Curie). The Abstract and Speaker's bio of the lecture are given below.

Abstract: In this seminar, the challenge pertinent to validating resilience of large engineering structures, both in terms of integrity to failure and ability to recover under extreme transient loads were addressed. Of particular interest are the effects of combined transient loads in industrial domains, such as civil and mechanical engineering. The effect of combined extreme transient loadings on a structure is not well understood - whether the source is manmade, such as an explosion and fire, or natural, as an earthquake or extreme wind loading. A critical assessment of current knowledge is timely (with Fukushima-like disasters or terrorist threats). The central issue in all these problems is structural integrity, along with their transient nature, their unexpectedness, and often the uncertainty behind their cause. No single traditional scientific discipline provides full answer, but a number of tools need to be brought together: nonlinear dynamics, probability theory, some understanding of the physical nature of the problem, as well as modeling and computational techniques for representing inelastic behaviour mechanisms. The seminar also covered model building for different engineering structures and provides detailed presentations of extreme loading



conditions. A number of illustrations are given: quantifying a plane crash or explosion induced impact loading, quantifying the effects of strong earthquake motion, quantifying the impact and long-duration effects of strong stormy winds - along with a relevant framework for using modern computational tools. The proposed approach considers the levels of reserve in existing structures, and ways of reducing the negative impact of high-risk situations by employing more sound design procedures.

Speaker's Bio: Professor Dr Adnan Ibrahimbegovic is Professor Classe Exceptionnelle, Member Senior IUF-Institut Universitaire of France and Chair for Computational Mechanics at University of Technology Compiègne, a member of Alliance of Sorbonne Université (created with merger of Paris-Sorbonne and Université Pierre Marie Curie). He has obtained his engineering education in Sarajevo, PhD at the University of California Berkeley, USA and Habilitation at University Pierre Marie Curie in Paris, France. He has held professorships and research positions at four different universities (including UC Berkeley, USA; EPFL, Switzerland; ENS-Cachan, France and currently UTC, France). He is the past Chairman of ENS-Cachan Teaching and LMT-Cachan Research Departments and Head of Master Program MaiSE. He has received a number of international distinctions, including IACM Fellow Award, Humboldt Research Award for Germany, Research Award for Slovenia, International Fellow NSERC Award for Canada, 'Claude Levy-Strauss' Chair for Univ. Sao Paulo, Brazil, 'Asgard' Chair for NTNU, Norway, KAIST Invited Professor, South Korea, 'Hôte Académique' Award for EPFL, Switzerland. He has published more than 200 papers in scientific journals and 10 textbooks and monographs.

INAE Bhubaneswar Local Chapter

Distinguished Lecture Series

INAE Bhubaneswar Chapter had initiated a series of distinguished Lectures with support of SOA University and IMMT Bhubaneswar. These Lectures were given by the distinguished academicians, researchers and industry experts. They are targeted to the faculty, senior students, researchers and professionals of the region and the follows, young engineers and associates of the academy. They are expected to motivate and energize them to do research and innovations.

6th Lecture of the Distinguished Lecture Series was jointly organised by INAE Bhubaneswar Chapter, SOA University and IMMT, Bhubaneswar in virtual mode. The lectures of the series are given by eminent Engineers/Scientists/Technologists from India and abroad for the benefits of the students/faculty/researchers/scientist/technologists of Colleges/ Universities/ Institutes. The 6th lecture of this series was given by Dr. Prasant Mohapatra, Professor, Department of Computer Science and Vice Chancellor for Research at University of California, Davis on April 05, 2022 on "Vulnerabilities in Federated Learning Networks".

Key Points:

With more regulations tackling the protection of users' privacy-sensitive data in recent years, access to such data has become increasingly restricted. A new decentralized training paradigm, known as Federated Learning (FL), enables multiple clients located at different geographical locations to learn a machine learning model collaboratively without sharing their data. While FL has recently emerged as a promising solution to preserve users' privacy, this new paradigm's potential security implications may hinder its widespread adoption. The existing FL protocols exhibit new unique vulnerabilities that adversaries can exploit to compromise the trained model. FL is often preferred in learning environments where security and privacy are the key concerns. Therefore, it is crucial to raise awareness of the consequences resulting from the new threats to FL systems. To date, the security of traditional machine learning systems has been widely examined. However, many open challenges and complex questions are still surrounding FL security.



In his talk, he provided an overview of the unique security vulnerabilities exposed by the FL networks. He highlighted the vulnerabilities sources, key attacks on FL, defenses, as well as their unique challenges, and discuss promising future research directions towards more robust FL.

Link to the Video: <https://youtu.be/C3z4ZO3y1zs>

People Participated: 135

The 7th Lecture was organized by INAE Bhubaneswar Chapter, SOA University and IMMT Bhubaneswar on “Hydrodynamics of sediment transport: grain scale to continuum scale” which was delivered by Prof. Subhasish Dey, Professor, Department of Civil Engineering, Indian Institute of Technology (IIT) Kharagpur on April 07, 2022.

Key Points:

A theory of sediment transport, describing the entrainment phenomenon from the grain scale to the continuum scale, under a steady-uniform flow over a sediment bed is presented. The sediment grains, assumed as discrete spherical grains, are subjected to turbulent wall-shear flows. At the grain scale, the forces acting on a sediment grain resting over three compact spherical grains are analysed to determine the criteria for entrainment threshold in rolling, sliding and lifting modes taking into account the turbulence effects. Comparison of the theoretical results with the experimental data shows that the entrainment threshold lies within the sliding and lifting modes. Then, at the grain scale, using the log-normal probability density function for the near-bed instantaneous horizontal velocity, the entrainment probabilities in rolling, sliding and lifting modes for a given grain size are derived. The rolling and sliding probabilities increase with an increase in Shields function and after attaining their individual maximum values, they reduce, while the lifting probability increases with Shields function. The maximum value of entrainment probability in rolling mode is close to the threshold Shields function in rough flow, while the entrainment probability in lifting mode initiates from the value of the threshold Shields function. In a continuum scale, the bedload flux is derived by hypothesizing the saltating mode of sediment transport incorporating the lifting probability obtained at the grain scale.

Link to the Video: <https://youtu.be/oqoXjHqCXM0>

People Participated: 130

The 8th Lecture of the Distinguished Lecture Series was organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar on “Natural materials for noise control of home appliances and automobile” and delivered on 5th May 2022 by Prof. Amiya Ranjan Mohanty, Professor & Head, Mechanical Engineering Department, Indian Institute of Technology, Kharagpur.

Key Points:

Traditionally, synthetic acoustic materials have been used for noise control, but they are costly and hazardous to environment. A recent trend is a shift towards natural fiber porous materials as these are low-cost, biodegradable and recyclable. This talk presented the effect of pre-treatment procedures on the acoustic, thermal and physical properties of a natural material, jute and composites made of jute. It is found that jute fibers and jute composites have high transmission loss, high sound absorption coefficient, low flammability, low density and high thermal stability. Thus, they are an excellent choice for industrial noise control. This talk also presented some case studies of jute-based noise control in household appliances, like



refrigerators, domestic clothes dryer, vacuum cleaners, mixer grinders and automotive HVAC systems. In every case study, jute composites, applied as sound absorbers and sound barriers, are able to significantly reduce the noise level by 4 dB or more, and improve the sound quality of the product. Therefore, jute composites have high potential as low-cost, light weight, sustainable materials for industrial noise control.

Link to the Video: <https://youtu.be/58DE2RcS0wA>

People Participated: 97

Bio of Speaker:

Prof. Amiya Ranjan Mohanty received the B.Sc. Engg. (Hons.) degree in mechanical engineering from the National Institute of Technology, Rourkela, in 1986, and M.Tech. degree in the area of machine design from the Indian Institute of Technology (IIT), Kharagpur, India, in 1988. He received his Ph.D. degree in the area of noise control from the University of Kentucky, Lexington, USA in 1993. He was with the Ray W. Herrick Laboratories, School of Mechanical Engineering, Purdue University, West Lafayette, USA, as a Postdoctoral Fellow, working in the area of active noise control. His research interests are in the areas of machinery condition monitoring, underwater acoustics, signal processing, acoustics and noise control.

Presently, he is a Professor and Head of the Department of Mechanical Engineering at IIT Kharagpur, India. He has worked in the R&D Division of Larsen and Toubro Ltd., Mumbai, India, in the area of machinery condition monitoring. He has also worked in Ford Motor Company, Detroit, USA, in the area of automobile Computer Aided Engineering/Noise Vibration & Harshness (CAE/NVH). His over 25 sponsored research projects and more than 100 consulting projects in the areas of noise control and machinery condition monitoring are funded by many government agencies and industries. He has more than 150 journal and conference publications, four book chapters and one book on “Machinery Condition Monitoring: Principles and Practices”, CRC Press, (2014), to his credit.

Prof. Mohanty held the Shyamal Ghosh and Sunanda Ghosh Chair Professor position at IIT Kharagpur. He is an elected fellow of the Indian National Academy of Engineering, Acoustical Society of India, Condition Monitoring Society of India, International Society of Engineering Asset Management, Institution of Engineers (India). He has received several awards like the Chancellor’s Award for Outstanding Teaching at the University of Kentucky (1993), Rais Ahmed Memorial (2009) and M. S. Narayanan Memorial (2015) Award of the Acoustical Society of India, Star Alumnus Award of NIT Rourkela (2015), Dr. V. Bhujanga Rao Endowment Lecture Award (2019) of the Condition Monitoring Society of India. He is also the recipient of the Overseas Academic Programme (OAP)-inbound fellowship of the National University of Singapore. Prof. Mohanty was selected as a participant in the LEAP programme of the MHRD at Cambridge University, UK in 2019.

The 9th Lecture of the Distinguished Lecture Series was organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar on “Si Photonics systems as interconnects in current data centres” and delivered on 7th May 2022 by Prof. Prasanta Kumar Basu, Retired Professor, Institute of Radio Physics and Electronics, University of Calcutta.

Key Points:

The copper or aluminum interconnects used in VLSI/ULSI circuits cannot be scaled down in the same ratio as the individual transistors are done. The RLC elements of metal limit severely the data rate and at the same time contribute to power dissipation. Optical interconnects now replace metal interconnects by offering

ultrahigh bandwidth, low power dissipation, freedom from insulation and fast processing speed. High data rate communication systems based on Silicon Photonics (SiPh) chips and optical fibre or waveguides connects different elements in servers and high-performance computers in current data centres. The short distance communication systems work at the board-to-board, node-to-node and even chip-to-chip levels. All elements in the system, modulators, detectors, mux/demux, waveguides and processing electronics excepting the laser, are integrated on Si platform by using standard CMOS processing technology.

The talk covered the basic of optical communication, devices used, interconnect bottleneck and the solution in terms of photonics SiPh. R&D work supported by government, academia, industries like Intel, TSMC, users like Facebook, Google etc, new vendors, and research groups in India were mentioned.

You tube Link to the Video: <https://youtu.be/xUTiioi0R70>

People Participated: 90

Biodata of Speaker

Prasanta Kumar Basu (b1946), B.Sc. (Physics, Presidency College), B.Tech, M.Tech, and Ph.D., retired from RPE/CU in 2011, and then worked as UGC BSR Faculty Fellow, Visiting Professors at IIT KGP and National Chung Cheng University (NCCU), Taiwan, and thereafter as an Investigator in an Indo-Taiwan project. In his long career as teacher, researcher, and administrator, he had nearly 140 journal papers, 4 books and 2 book chapters all from international publishing houses, and he guided and is still guiding more than 20 Ph.D. students. He initiated an international conference series CODEC and earned for the department the title UGC Networking Resource Centre in Physical Sciences: the first in India. He worked as a post doc in Belgium, Alexander von Humboldt fellow in Germany, first INSA Research fellow, visiting professors in TIFR, McMaster University, Canada, NCCU and INSA-Royal Society Exchange professor in UK. He also served for 8 years as a member of EPSRC College, UK, to review their projects. Currently, he is engaged in joint research and book writing with faculties of RPE, NIT Delhi, McMaster University and NCCU- Taiwan.

Technology Day Lecture on “Climate Change, Extreme Weather Events and Technological Intervention for Sustainable Development” on 11th May 2022

Technology Day Lecture of the Distinguished Lecture Series was organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar on “Climate Change, Extreme Weather Events and Technological Intervention for Sustainable Development” delivered on 11th May 2022 by Prof. Uma Charan Mohanty, School of Earth, Ocean and Climate Sciences (SEOCS), IIT Bhubaneswar, Argul, Khurda, Odisha.

The 10th Lecture of the Distinguished Lecture Series was organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar featuring Lecture by Prof. Farrokh Mistree, L.A. Comp Chair and Professor, School of Aerospace and Mechanical Engineering, University of Oklahoma, Norman, Oklahoma, USA on “Atmanibhar Bharat 2047: On Moving Indian Higher Education Institutions up in the World Rankings” on 17th June 2022

Key Points: India will celebrate its 100th year of independence in 2047. In this webinar the aim was to foster dialog on what Atmanibhar Bharat in 2047 will look like. It is hypothesized that transdisciplinary research and collaboration is key to developing the technology to achieve societal goals such as environmental justice, social justice and the like. He asserted that transdisciplinary research and collaboration is foundational to



addressing not only cutting-edge challenge problems but also in defining bleeding edge research opportunities that will position Indian academic institutions to become the virtual destination of choice for people from around the world and thence catapult some academic institutions up in the world rankings. 96 people participated in the event. You tube Link of the Video : <https://youtu.be/q1yqNGfRauE>

The 11th Lecture of the Distinguished Lecture Series was organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar featuring Lecture by Prof. Sukumar Mishra, Professor, Department of Electrical Engineering, Indian Institute of Technology Delhi on “Distributed Energy Resources Rich Microgrid: Operation and Control” on 11th June 2022.

Key Points: Distributed energy resources (DERs), mostly solar and wind farms, are getting prime interest of the power system operators to overcome shortage of fossil fuels and for sustainable growth of the grid. It is necessary to understand the behaviour of voltage source inverters (VSIs) due to its importance in integrating DERs in the microgrids. Additionally, good understanding of transition from synchronous generators (SGs) to the VSIs is required to achieve smart operation and control of the power network. There are several methods available for effective operation of the VSIs, which are mostly categorized in three modes. Firstly, grid following (GFL) operation of VSIs to meet the voltage and frequency of the grid at the local point of common coupling. The phase lock loop (PLL) is crucial in GFL mode, which synchronizes VSI with the grid. It is difficult to synchronize the VSI through PLL, with a weak grid. Therefore, GFL operation is more effective in SG rich and strong power system. Followed by the synchronization process, the DERs can transmit the power to satisfy their local load and the grid. Secondly, VSIs operate in grid supporting (GS) mode. Some of the popular GS functionalities are frequency, reactive, inertial and voltage support. Power regulatory authority of different countries impose grid codes for the operation of generating units comprising of DER in the distribution system. DER operator adheres to the grid codes to maintain operation of the VSI in GFL and GS mode. Last but not the least, grid forming (GFM) operation of the VSIs, which is effective in autonomous microgrid and weak grid system. Unlike GFL mode, there is no requirement of PLL in GFM mode of operation and control of VSIs. The DERs in the micro-grid are operated in conventional droop to handle active and reactive power flows to maintain demand and generation balance of the system. The widely used conventional droop is P-f and Q-V droop (depends on the R/X of the network) which is used in power sharing among the DERs. The droop equation for low R/X network is modified for proper sharing of power among the DERs. The choice of droop coefficient of the DERs is a critical task as it is highly motivated by the economics of the plant as well as the network parameters. 64 people participated in the webinar. You tube Link of the Video: <https://youtu.be/emXKhfgiEl8>

The 12th Lecture of the Distinguished Lecture Series organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar by Prof. Barada Kanta Mishra, Director IIT Goa on “Discrete Element Analysis of Particulate Systems” was held on 9th July 2022.

Key Points: Particles are ubiquitous—avalanches, coating, powder mixing, optoelectronic device making, etc., involve particles. It is estimated that 70% of industrial processes involve particulate material of some form or other. Surprisingly though, not much is understood about this exciting class of material, mainly due to the complex behavior that develops when many particles interact. However, simulation of particulate systems using mathematical modeling tools has been gaining ground. As a result, it has been increasingly used to design, scale-up, improving process efficiency, debottlenecking, etc. He has successfully used the discrete element method (DEM) to analyze various particulate systems covering both theoretical and practical aspects. Here he mainly discussed three topics of industrial importance: (i) Breakage of particles, (ii) breakage of agglomerates, and (iii) mixing and segregation of particles. He illustrated how DEM simulations

capture the underlying physical phenomena of particulate systems while providing a better understanding of the underlying principles governing the processes. 46 people participated in the webinar. You tube Link of the Video: <https://youtu.be/DD38JoN30qA>

13th Lecture of the Distinguished Lecture Series organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar by Prof. Ashutosh Dutta, Chief 5G Strategist and Fellow at Johns Hopkins University Applied Physics Labs and Chair of Electrical and Computer Engineering for Engineering Professional Program at JHU on “5G Networks and Security -Opportunities and Challenges” was held on 13th July 2022.

Key Points: Software Defined Networking (SDN) and Network Function Virtualization (NFV) are the key pillars of future networks, including 5G and beyond that promise to support emerging applications such as enhanced mobile broadband, ultra-low latency, massive sensing type applications while providing the resiliency in the network. While NFV and SDN open up the door for flexible networks and rapid service creation, these also offer both security opportunities while also introducing additional challenges and complexities, in some cases. With the rapid proliferation of 4G and 5G networks, operators have now started the trial deployment of network function virtualization, especially with the introduction of various virtualized network elements in the access and core networks. This talk addressed evolution of cellular technologies towards 5G but largely focuses on various security challenges and opportunities introduced by SDN/NFV and 5G networks and enablers such as Hypervisor, Virtual Network Functions (VNFs), SDN controller, orchestrator, network slicing, cloud RAN, edge cloud, and security function virtualization. This talk introduced a threat taxonomy for 5G security from an end-to-end system perspective, potential threats introduced by these enablers, and associated mitigation techniques. At the same time, some of the opportunities introduced by these pillars are also discussed. This talk also highlighted some of the ongoing activities within various standards communities including open source consortiums, large scale testbeds, and illustrates a few deployment use case scenarios for security. 54 people participated in the webinar. You tube Link of the Video: <https://youtu.be/fPkotjmSxFU>

14th Lecture of the Distinguished Lecture Series organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar by Prof. Gopalan Jagadeesh, Professor in the Department of Aerospace Engineering, Indian Institute of Science Bangalore on “ Shocking - Yet True...” was held on 22nd July 2022.

Key Points: The phenomenon of “Shock Waves” has been historically associated with aerospace engineering and in particular with supersonic flight. Shock waves appear in nature, when different elements in a fluid approach one another with a velocity higher than the local speed of sound. These waves are also generated if massive energy dissipation takes place within ultra-short time in events like explosions. A number of methodologies/facilities to generate shock waves of requisite strength have been designed and indigenously built in the Laboratory for Hypersonic and Shockwave Research (LHSR) in Indian Institute of Science (IISc), Bangalore. Over the years, these facilities have facilitated very interesting interdisciplinary research programs in IISc with participation of several faculty members from physics, chemistry, biology and materials engineering. Some of the novel techniques that were discussed in this talk includes retractable aerospikes, smart coatings, forward facing jets and concentrated energy deposition for reducing the aerodynamic drag around vehicles flying at hypersonic speeds. Concurrently, utilizing the remarkable ability of shock waves to instantaneously enhance the pressure and temperature in the propagating medium, several innovative shock wave assisted techniques have been developed in LHSR. These include non-intrusive needleless vaccine delivery, cell transformation, Wound healing, bio-film destruction, sandal oil extraction,



polyphenol enrichment in tea, metal texture modification, and preservative impregnation in bamboo. A broad overview of the recent Transdisciplinary shock wave research and technology development activities at LHSR were presented in this lecture. 62 people participated in the webinar. You tube Link of the Video : <https://youtu.be/KjL7k8EvYg8>

15th Lecture of the Distinguished Lecture Series organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar featuring Lecture by Prof. Janet Katherine Allen, John and Mary Moore Chair of Engineering and Professor of Industrial and Systems Engineering, The School of Industrial and Systems Engineering, The University of Oklahoma on “From Make in India to Design and Make in India” was held on 10th August 2022.

Key Points : In the context of the Design and Make in India mantra he planned to highlight some of the opportunities embodied in the Industry 4.0 construct that is associated with manufacturing and introduce the Design Engineering 4.0 construct that complements the Industry 4.0 construct. Foundational to sustaining Design and Make in India is basic research. Accordingly, she touched upon the state of government funding of basic research and how it could be directed to further the Design and Make in India mantra. 48 people participated in the webinar. 48 people participated in the webinar. You tube Link of the Video: <https://youtu.be/2twU2345HUg>

16th Lecture of the Distinguished Lecture Series organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar featuring Lecture by Prof. Laxmidhar Behera, Director, Indian Institute of Technology Mandi, Himachal Pradesh on “Development of Cognitive Robotic Systems: Challenges and future perspectives” was held on 9th September 2022.

Key Points: Robots have evolved from caged environments to be able to operate within sociable platforms. Warehouse automation, Smart Education, Healthcare and entertainment have played significant roles for such a transformation where robots behave more human-like. In this talk, some selected applications in warehouse automation were presented. An example was presented to illustrate if such robotic systems are really cognitive in real-sense! Next, the efficacy of imitation learning was demonstrated in the development of cognitive robotic systems. The challenges while naturalizing strong AI in robotic systems were enumerated. 64 people participated in the webinar. You tube Link of the Video : https://youtu.be/SwVEN_8VEzM

17th Lecture of the Distinguished Lecture Series organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar featuring Lecture by Professor Bidyadhar Subudhi, School of Electrical Sciences, Indian Institute of Technology Goa on “Navigation and Control of Marine Vehicles” was held on 16th September 2022.

Key Points: Research on navigation and control of marine vehicles (unmanned surface vehicles and autonomous under water vehicles) has received increased attention for several obvious reasons such as understanding marine environment for scientific exploration and their interesting applications. Some of the applications include ocean survey, pipe-line inspection, environmental data gathering, sampling, bathymetric mapping and defence. However, these applications necessitate designing effective motion control algorithms for marine vehicles. In view of accomplishing control design successfully there is a need of accurate representation of dynamics of marine vehicles involving hydrodynamic damping, Coriolis terms, mass and inertia terms. Control design for an autonomous under water vehicle is challenging owing to parametric uncertainties arising from hydrodynamic parameters and external disturbances due to variation in oceanic

currents. In this talk, modelling, control design and real-time implementation of the control algorithms for autonomous under water vehicle were discussed. 47 people participated in the webinar. YouTube Link of the Video: <https://youtu.be/McEqHPfwLVY>

The 18th Lecture of the Distinguished Lecture Series organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar featuring Lecture by Professor Ashok Kumar Pradhan, FNAE, Senior Member, IEEE, Institute Chair Professor and Chairperson, Subir Choudhury School of Quality and Reliability, Indian Institute of Technology Kharagpur on “Importance of Precision-Time in Electric Grid: Availability and Usages” was held on 21st September 2022.

Key Points: Today timing is essential to a wide variety of network functions and equipment in electric grids. Precise and reliable time is now available at reasonable cost worldwide. The electric grid operates as a single, complex and massively interconnected synchronous system. What happens in one part of the grid affects operation elsewhere. Managing and controlling these interactions require a means to compare the status at one place and time with the condition all around at the same instant. Precise time and high-speed communications in the substations are the enabling technologies which make this practical. Highly accurate and free to access, GPS timing signals have been incorporated into wide variety of applications such as to improve system reliability, reduce operation costs, better understand power system operation, predict and prevent system-wide faults, test and verify operation of protective devices. This talk explained some of these applications related to ‘time’ as important information, discuss sources and distribution of precise time, and helped to understand how to apply commercially available products to synchronize power system equipment even in the presence of large-scale renewable sources. Scope of future technology in this domain were also addressed. 54 people participated in the webinar. YouTube Link of the Video: <https://youtu.be/i2w8-XYNOWU>

The 19th Lecture of the Distinguished Lecture Series was organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar on 19th October 2022 on “CPS, IoT and AI” by Prof. U B Desai, Former Director IIT Hyderabad. The talk provided a high-level view of CPS (Cyber Physical Systems), IoT (Internet of Things), and AI (Artificial Intelligence). All these three areas are playing a major role in today’s technology and also near-term future technologies. All the three domains are very vibrant with AI and CPS leading the way. There is a lot of overlap among CPS, IoT and AI. The talk focused on various applications of IoT, CPS and AI. The applications will be in the broad areas of precision agriculture, autonomous navigation, vehicle detection, and Intelligent transportation. 44 people participated in the talk.

The 20th Lecture of the Distinguished Lecture Series was organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar on 3rd November 2022 on “Konarka Temple and Its Iron Beams: An Epitome of Aesthetics & An Engineering Feat” by Prof. Omkar Nath Mohanty, Director, Technology & Academic Initiative, RSB Metaltech., RSB Group, Pune.

Key Points: Konarka, the magnificent temple with exquisite sculpture described by Tagore as a ‘Poem in Stone’ for worshipping the Sun God and declared by UNESCO a World Heritage Site in 1984, is situated about 32 kms. North of Puri, on the shore of the Bay of Bengal. The temple is associated with the legend of Samba, the son of Lord Krishna, getting cured of his curse of leprosy through penance before the Sun God on the banks of Chandrabhaga, the holy river that was flowing nearby (now, dried up, only subterranean). The Konarka temple is known to have been completed in the mid-13th century with the main temple rising to over 230 feet from the ground. In one of the earliest eye-witness accounts of the standing temple in its full glory, Abul Fazl, the famous historian in the court of Mughal Emperor Akbar (1556-1605 A.D.), pays



glowing tributes to the great edifice in his Ain-i-Akbari. It was probably the tallest temple in the world then. Sadly, the main temple housing the presiding deity collapsed, presumably in the 17th century. Although the causes of collapse have not been unequivocally established yet, the principal reason for the ‘fall’ appears to be the structural instability due to land subsidence caused by the proximity to the sea-shore and the resultant inadequate strength of foundation. There are many popular ‘theories’ about the construction and collapse of the main temple, which are by and large apocryphal. The only portion of the temple that is still standing in its near-entirety is the Jaga Mohana, or the Audience Hall (commonly referred to as ‘Black Pagoda’ by the European navigators). This came to light in its ruinous state during the early phase of the British rule (beginning in 1803) of Odisha.

Apart from extensive excavations (over 50 years) to unearth the buried portions, some steps were considered necessary for saving this structure from possible collapse. The four entrances were permanently closed, and the interior was filled with sand vertically from the top by drilling a hole and pouring sand through a funnel in order. This exercise was started in the year 1903 and completed in 1909 under the supervision of Bishan Swarup, an engineer from Patna. Over the past 113 years the sand level is known to have descended 4 – 5 metres, after absorbing moisture, and is therefore considered to have outlived its purpose of supporting the structure from inside. The Govt. of India has therefore decided recently to extract the sand from inside, take measures to ensure its integrity and eventually make the interior accessible to visitors. 63 people participated in the talk. The video recording of the talk can be viewed at the YouTube Link: <https://youtu.be/s7UyGpBZugo>

The 21st Lecture of the Distinguished Lecture Series was organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar on 25th November 2022 on “Accelerator Architectures for Deep Neural Networks and Homomorphic Encryption” by Prof. Keshab K. Parhi, Dept. of Electrical & Computer Engineering, University of Minnesota, Minneapolis.

Key Points: Machine learning and data analytics continue to expand the fourth industrial revolution and affect many aspects of our lives. The talk explored hardware accelerator architectures for deep neural networks (DNNs). A brief review of history of neural networks (IEEE OJCAS-2020) was presented and covered his recent work on Perm-DNN based on permuted-diagonal interconnections in deep convolutional neural networks and how structured sparsity can reduce energy consumption associated with memory access in these systems (IEEE MICRO-2018). He also talked about reducing latency and memory access in accelerator architectures for training DNNs by gradient interleaving using systolic arrays (IEEE ISCAS-2020). He presented his recent work on LayerPipe, an approach for training deep neural networks that leads to simultaneous intra-layer and inter-layer pipelining (ACM/IEEE ICCAD-2021). This approach can increase processor utilization efficiency and increase speed of training without increasing communication costs. Finally, he described ongoing work on accelerators for homomorphic encryption, computing in the encrypted domain. 71 people participated in the talk. The video recording of the talk can be viewed at the YouTube Link: <https://youtu.be/QQr8SdKSmKs>

The 22nd Lecture of the Distinguished Lecture Series organised by INAE Bhubaneswar Chapter, jointly with SOA University and IMMT Bhubaneswar on 5th December 2022 on “Design of Experiments” by Professor Tapan P. Bagchi, Indian Institute of Technology Kharagpur; Vinod Gupta School of Management, Kharagpur; Adjunct Professor of Quantitative Methods.

The 23rd Lecture of the Distinguished Lecture Series was organized by INAE Bhubaneswar Chapter on 27th February 2023 wherein Dr. Ashwini K. Nanda, Founder and CEO of HPC Links Pvt Ltd, in India and USA delivered a talk on “Applied Research in Computer Architecture, AI, and HPC - a Personal Journey”



Key Points: Discussion on the primary challenges of extreme-scale AI-coupled HPC campaigns -- task heterogeneity, adaptivity, performance -- and several framework and middleware solutions which aim to address them. While both HPC workflow and AI/ML computing paradigms are independently effective, the talk highlight how their integration, and ultimate convergence, is leading to significant improvements in scientific performance across a range of domains, ultimately resulting in scientific explorations otherwise unattainable. The presentation thoroughly explained an Exascale applications from the Autonomous Driving, Cancer Research which starts from molecular level to drug level modelling, diagnosis, patient tracking etc. and many more. The talk also covered the Proposed Integrated Labs and Industry 4.0 Focus too. 45 people participated in the talk.



Mentoring of Engineering Teachers/Students by INAE Fellows

The Governing Council in its meeting held in March 2023 approved that in order to benefit the teachers and students in engineering colleges/institutions across the country and based on the previous success of the schemes, the “Mentoring of Engineering Teachers by INAE Fellows/ INAE Young Associates” and “Mentoring of Engineering Students by INAE Fellows/ INAE Young Associates” schemes may be continued, despite the present situation wherein it is envisaged that there may be a reduction in available grant for the conduct of the schemes, on prevailing guidelines. Therefore, certain amendments were recommended in the Guidelines and Application form in both the mentoring schemes in terms of the financial emoluments pertaining to the schemes such as contingency grant for the mentor and travel support for mentee be suspended, subject to prevailing fund position. It was further recommended that the Mentoring be conducted in hybrid mode with suspension of Contingency Grant to mentors and travel support to Mentees and only Rs 5000/- as project support for the Mentees (Engineering Teachers/Students) be provided. Applications for the year 2023 for Mentoring of Engineering Teachers/ Students by INAE Fellows/ Young Associates were invited with the revised guidelines and last date of receipt of nominations was May 31, 2023.

INAE Research Schemes- INAE Distinguished Professors/Technologists and INAE Chair Professorship Scheme

The Governing Council in its meeting held in March 2023 amended the INAE Distinguished Professors/ Technologists and INAE Chair Professorship schemes for the ensuing FY 2023-24 due to reduced allotment of funds as received from DST. Further, fresh nominations were invited after revisiting the guidelines pertaining to honorarium and financial emoluments with no/ reduced financial provisions on voluntary basis, subject to prevailing fund position of INAE. It was further recommended that a token honorarium of Rs 10,000/-be granted to the selected nominees under both schemes w.e.f. April 1, 2023. Applications for the year 2023 for both the schemes were invited with the revised guidelines from the Fellows of the Academy and last date of receipt of nominations was May 31, 2023

INAE Expert Groups

The objective of the “INAE Expert Group to Prepare Technology Roadmaps with Actionable Recommendations” initiative launched in the year 2020, is development of a comprehensive engineering/technology road map with actionable recommendations on selected engineering themes or domains to help the country formulate a policy/strategy for implementation. The ongoing proposals are on ‘Accelerated Materials Discovery, Scale-up and Exploitation Strategy for Strategic Materials Needs of India’ with Principal Investigator: Dr. Biswajit Basu, Former Dy. CTO & Head, Aditya Birla Science & Tech Co. Pvt. Ltd; ‘Industrial By-products (IBPs) for Sustainable Infrastructure Development’ with Principal Investigator: Prof. DN Singh, IIT Bombay; ‘Advanced Microwave- Terahertz wave Technology & Applications- Way ahead for India’ with Principal Investigator: Dr Lalit Kumar, Adjunct Professor, BITS-Pilani, Hyderabad, Former Chairman, CEPTAM, Former Director, MTRDC-DRDO, Bangalore; ‘Technology roadmap for capture and conversion (CCUS) of CO₂ to value added chemicals’ with Principal Investigator: Prof KK Pant, Director, IIT Roorkee; and ‘Infrastructure and Resource Requirements for Introduction of Automation and its Adoption in the Mineral Sector of India: A Stakeholder Engagement’ with Principal Investigator: Prof. Jayanta Bhattacharya, IIT Kharagpur. During March 2023 it was decided that the Principal Investigators be invited to make a presentation before the Steering Committee on the progress of work undertaken vis-à-vis the laid down objectives. The progress is satisfactory and the final reports as outcome of the proposals are expected to be ready shortly.



Frugal Innovation Nurturing Program (FINP)

An initiative to promote the Frugal Innovation in the country, Frugal Innovation Nurturing Programme (FINP) was initiated by INAE in 2018. For this purpose, Innovation Promotion Committee had been constituted which was chaired by Dr V Bhujanga Rao, FNAE. An MOU between INAE and National Innovation Foundation (NIF) was signed to be extended for another 3 years to support FINP program. The committee identify certain impactful innovations with the help of National Innovation Foundation (NIF) that have reached prototype stage (TRL 4-5) and have been successfully tried in the field but were limited in out-reach owing to limited infrastructure/means available with the inventor. So far five such grassroots projects of TRL 4-5 had been upgraded to TRL 8-9 through S&T intervention. For one such innovation of Improved the design of a tractor driven paddy planter, M/s John Deere India has signed agreement to this effect with the grassroot Innovator by paying the agreed royalty. Further six additional frugal innovations have since been identified and are under progress for scaling up of TRL. The FINP committee identified several grassroots projects of TRL 4-5 and upgraded them to TRL 8-9 through S&T intervention by taking the support of National Innovation Foundation (NIF) and academic institutions to scale up the technologies. Seven projects have been successfully completed. INAE would continue to support the initiative in an advisory role on honorary basis without financial outlay.



INAE Digital Platform

A Digital Platform for INAE was conceptualized during August 2018. Initially twenty-two modules were identified to facilitate acceptance of online nominations and online applications for INAE Schemes, AICTE Schemes and SERB scheme and their subsequent processing. The platform has been expanded over the years and plans include digitizing of INAE office activities. During the years 2020, 2021, all meetings and events of INAE were conducted online. In 2022, with easing travel restrictions meeting and events are being organized in hybrid mode, with complete support from the in-house platform. The nominations for INAE Fellowship were invited online and review of the nominations were also encouraged online so that each reviewer can go through the respective nominations beforehand and have an effective selection meeting together with other members of corresponding Review Committees. The response is satisfactory. With expansion of activities, the infrastructural changes have been made accordingly in the existing platform keeping in view directives.



International Affairs

CAETS 2022 Annual Meeting and Convocation

As the only engineering Academy of the country, INAE represents India at the International Council of Academies of Engineering and Technological Sciences (CAETS); which is a premier non-governmental international organization comprising of Member Academies from 31 countries across the world, with the objective of contributing to the advancement of science and technology and promoting sustainable economic growth of all nations. INAE also organizes workshops/events with CAETS Member Academies on topics of mutual engineering interest. CAETS 2022 Annual meetings and Conference was hosted by the National Academy of Technologies of France (NATF) in Versailles, near Paris, France. The International Conference on “Engineering a better world: Breakthrough Technologies for Healthcare” was held on September 27-28, 2022. INAE delegation led by Prof Indranil Manna, President, INAE comprising of Prof Sushmita Mitra, FNAE; Prof GK Ananthasuresh, FNAE; Dr Sharmila Mande, FNAE and Lt Col Shobhit Rai (Retd), Deputy Executive Director, INAE, participated in the subject event. The following two speakers from INAE delivered talks: Prof Sushmita Mitra, Professor at the Machine Intelligence Unit (MIU), Indian Statistical Institute, Kolkata was a Speaker during Technical Session 2 - The Foundations of Information and Communication Technologies (ICT) for Biology and Health on September 27, 2022 on the topic “Intelligent Analysis of Biomedical Images”. Prof GK Ananthasuresh, Professor, Mechanical Engineering & Dean of Mechanical Sciences at Indian Institute of Science Bangalore was a Speaker during Technical Session 3 - Disruptive technologies and global R&D trends on September 28, 2022 on the topic “Micromachinery for Mechano-diagnostics”.

During the event, the winners of the CAETS Communication Prizes were also announced. The nominations for the prize were sought from all member academies during April 2022. INAE had circulated an email requesting for suitable nominations to INAE Fellowship, INAE-SERB Abdul Kalam Fellows, INAE Young Innovator and Entrepreneur Awardees from previous years and INAE Student Projects Awardees from previous years in various categories for (1) Engineering Success Stories (2) High Potential Innovations. Prof Jayanta Mukhopadhyay, FNAE, Professor, Department of Computer Science and Engineering, IIT Kharagpur was conferred with the CAETS Communication prizes 2022 in the Category “High Potential Innovations” with a title of entry “iMediXcare Telemedicine System”. Prof Sushmita Mitra was interviewed during the event and the same can be viewed at the link given below.

<https://e1.pcloud.link/publink/show?code=kZLv18Z5LcwTTmjzxStnvYy19sUqRK34nvy>

Several Meetings of President INAE and INAE Delegation were held on the side lines of CAETS with the representatives of other Academies including US NAE; acatech, Germany; Engineering Academy of Japan; NAEK, Korea; Royal Academy of Engineering, UK; National Academy of Technologies of France (NATF); Croatian Academy of Engineering etc to explore possibility of joint programs and their method of obtaining funds. The Academies expressed working interest to collaborate with INAE on joint technical programmes/activities in virtual/physical mode such as exchange visits, joint programmes, joint call for proposals, outreach to respective Governments for research funding, student internship and mentoring of students etc. It was ascertained from all the foreign Academies with whom meetings were held, that they receive funds for conduct of their activities either directly or indirectly from their respective Governments.

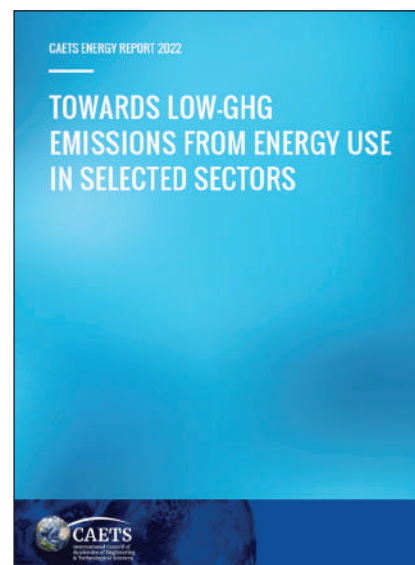
CAETS Engineering Education Working Group

The CAETS Council had requested President, INAE to Chair the CAETS Engineering Education Working Group (EEWG) for which consent has been given by INAE. A Meeting of CAETS Engineering Education Working Group was held on March 31, 2023 which was Chaired by President, INAE and attended by experts from INAE to discuss the questionnaire from CAETS and the way forward in bringing out a pertinent policy paper with actionable recommendations on promoting the growth of Engineering education across the world. The objectives of the Group are central to the CAETS policy on Engineering Education: (i) Promote ethics in engineering education, research, and practice and (ii) Contribute to continuous improvement and modernization of engineering education and practice internationally. Since engineering is all about translating fundamental knowledge into viable solutions to address human aspirations and societal challenges, engineering education must connect to the industrial practices and demands, application methodology, technological innovations awaited, and challenges related to raw materials, energy, environment, and efficiency. The overarching aim is to develop an engineering education policy that will promote economic growth and prosperity for the entire world with optimal use of resources and without inviting any penalty.

The Questionnaire covers the following points i) Vision and Mission and (ii) Policy or Committee or Mandate on Engineering Education of the Academy; Suggested topics for this EEWG (up to 5) that should relate to the overall goals of CAETS and objectives of the other WGs of CAETS; Suggestion on the functioning (meetings, information exchange, documentation, deliverables) and main objectives on this EEWG and Suggestion on the functioning (meetings, information exchange, documentation, deliverables) and main objectives on this EEWG. A short note was also requested on Engineering Education Curriculum in the concerned country (years of education to obtain a degree or diploma, name of the Regulatory Body, most popular and subscribed branches of engineering in that country, major strength, challenges, and priorities of the industry, etc.). These inputs would help understand the importance of engineering education and the scope of industry-academia synergy in the concerned country. INAE is Chairing this activity and shall play a major role in steering this activity to its logical conclusion through interaction with Member Academies of other countries and deliberations/consultations to be held online in arriving at the envisaged policy recommendations to further the cause and growth of engineering education in India and abroad.

CAETS Energy Report

The CAETS 2022 Energy Report on “Towards Low-GHG Emissions from Energy use in Selected Sectors” was released during the CAETS 2022 Annual Meetings and International Conference on “Engineering a better world: Breakthrough Technologies for Healthcare” hosted by the National Academy of Technologies of France (NATF) in Versailles, near Paris, France on September 27-28, 2022, in which INAE Delegation led by Prof Indranil Manna, President, INAE participated. Mr Pradeep Chaturvedi, FNAE had been nominated as INAE representative for CAETS Energy Committee and Mr Pradeep Chaturvedi and Dr. Bibek Bandyopadhyay had been invited as INAE members for Working Group on Buildings for CAETS Energy Committee. Prof. SS Chakraborty, FNAE had also been nominated INAE Member for Working Group on Cement Industry for CAETS Energy Committee. Mr Pradeep Chaturvedi, FNAE; Prof Bibek Bandyopadhyay, FNAE and Prof SS Chakraborty, FNAE along with





other INAE Fellows contributed to preparation of the said report with representatives of other CAETS Member Academies and members of CAETS Energy Committee from other countries. Internally, Dr Ajay Mathur, FNAE, Chairman, INAE Forum on Energy was also consulted by nominated INAE Fellows in preparation of the Study. During the CAETS 2022 Annual Meeting at France the contributions of INAE Fellows in preparation of the said report was highly appreciated. A brief on the report is given below.

Introduction: The Energy Committee of the International Council of Academies of Engineering and Technological Sciences (CAETS) has been tasked with reviewing existing technologies which can be used immediately to reduce greenhouse gas (GHG) emissions in seven key sectors: Food and Agriculture, Buildings and Smart Cities, Oil and Gas, Chemicals, Cement, Iron and Steel, Information and Communication technologies. Some of our conclusions could apply as well to other sectors like aluminium. The deployment of these technologies would lead to deep emission reduction before 2040 which explains why the primary time frame of the report is 2020-2040. However, these technologies are not sufficient to meet net zero targets by mid-century. Therefore, the report also highlights research and development needs for new or improved technologies and demonstrations for the near ready technologies (RD&D). While many cost-effective GHG mitigating technologies exist, the GHG emissions are still growing in many countries and worldwide. Indeed, many obstacles remain. The purpose of this report is not to analyse all of them. Undeniably, social and economic issues are critical to the global implementation of the Paris COP21 Agreement and subsequent COP meetings. These issues include: the impacts of world population growth, improvements to the quality of life in developing countries and regions, choices made by political and industrial leaders, etc., and they are important aspects. However, they are not within the scope of this report which is technical, and it is meant to highlight technologies suitable for lowering GHG emissions, their advantages and limitations, and describe the technical, economic and cultural barriers that may exist. The Report offers insights; conclusions and recommendations that should be useful for leaders of industry, governments, professional organisations (especially engineering organisations), non-governmental organisations, and citizens. The report is intended to provide clarity on the complex issues of our subject: what is possible for the next 20 years, where are the difficulties in the different sectors and how to overcome them.

Who prepared this report and how?

The CAETS (International Council of Academies of Engineering and Technological Sciences) Member Academies have three main characteristics: (1) their members are drawn from most sectors of activity, mainly from industry and academia; (2) they are collectively independent and neutral, without a priori advocating for any technology or sector; (3) their reports are evidence-based and resulting from exchanges based on facts and on their diversity of experience. Indeed, CAETS, with its different Member Academies from various countries, reflects this diversity. They are allowing an international approach illustrated by the numerous case studies and examples reproduced in this report prepared by more than 60 fellows and some external experts of more than 20 countries. Given the time (15 months) and the resources available for the preparation of this report, they have looked for sectors with substantial emission levels and where the diversity of active members could make the greatest contribution. In 2019, the seven sectors selected accounted for 73% of industry's CO₂ emissions (see Chapter 0, Fig. 0.2.) and around 60% of worldwide methane emissions. They did not select electricity generation as this topic was already largely covered by previous reports, neither the transport sector which could be an entire future study by its own. In this report, each of the above sectors is the subject of a dedicated chapter prepared by a subgroup of the Committee and discussed by the Committee. Each chapter was reviewed by external and internal reviewers. The chapters do not claim to be exhaustive but present the main elements, as seen by the participants, and are accompanied with examples taken from different countries. During the meetings, held remotely via teleconferencing, key messages and recommendations emerged from our often-lively discussions. They are not necessarily original or new but should, nevertheless, be most useful to implement.

The Fellowship

The selection process for election to the Fellowship was reviewed a few years back and modified wherein two stage selection process had been introduced. The comments from the Fellowship on the nominations received are also obtained prior to the first meeting of the Sectional Committees. In the first stage, the nominations are initially shortlisted to seek peer review reports from the recommended Fellows/domain experts. In the second stage, the peer review reports received are considered by the Sectional Committees to recommend nominations for election to the Fellowship for approval of the Governing Council. The following were elected as Fellows of the Academy w.e.f. November 1, 2022.

Newly elected Fellows

Engineering Section-I (Civil Engineering)



- 1 **Prof Manoj Kumar Arora**, Vice Chancellor,
SRM University, Guntur District, Andhra Pradesh



- 2 **Dr -Ing. Saptarshi Sasmal**, Senior Principal Scientist & Head,
Special and Multi-functional Structures Laboratory,
CSIR-Structural Engineering Research Centre, Chennai.



- 3 **Dr Anandavalli Narayanan**, Director,
CSIR-Structural Engineering Research Centre, Chennai.

Engineering Section-II (Computer Engineering & Information Technology)



- 1 **Prof Amit Kumar**, Jaswinder and Tarwinder Chadha Chair Professor,
Department of Computer Science and Engineering,
Indian Institute of Technology Delhi, New Delhi.



- 2 **Prof Umapada Pal**, Professor,
Computer Vision and Pattern Recognition Unit,
Indian Statistical Institute, Kolkata.



- 3 **Prof. Nitin Saxena**, Professor (N Rama Rao Chair),
Department of CSE, Indian Institute of Technology Kanpur, Kanpur.



- 4 **Dr. Prateek Jain**, Senior Staff Research Scientist,
Google Research India, Google AI Research Lab, Bangalore.



- 5 **Dr. Ranjita Bhagwan**, Former Senior Principal Researcher,
Microsoft Research India, Bangalore

Engineering Section-III (Mechanical Engineering)



- 1 **Prof. Surjya Kanta Pal**, Professor in Mechanical Engineering;
Lord Kumar Bhattacharyya Chair Professor in Manufacturing,
Indian Institute of Technology Kharagpur.



- 2 **Prof. Janakarajan Ramkumar**, Professor,
Micro Machining Laboratory, Mechanical Engineering Department,
Indian Institute of Technology Kanpur.



- 3 **Prof. Ranjan Ganguly**, Professor,
Department of Power Engineering, Jadavpur University, Kolkata



- 4 **Prof. Naresh Bhatnagar**, Professor of Mechanical Engineering,
Indian Institute of Technology Delhi



- 5 **Dr. Dhananjaya Dendukuri**, Chief Executive Officer and Co-Founder,
Achira Labs, Bangalore

Engineering Section-IV (Chemical Engineering)



- 1 **Prof. Jayant Kumar Singh**, Poonam and Prabhu Goel Chair Professor and Head,
Department of Chemical Engineering, IIT Kanpur



- 2 **Prof. Pramod Prabhakar Wangikar**, Professor,
Department of Chemical Engineering, Indian Institute of Technology Bombay



- 3 **Dr. Avesh Kumar Tyagi**, Director, Chemistry Group, MOD Lab.,
Bhabha Atomic Research Centre (BARC), Mumbai.

Engineering Section-V (Electrical Engineering)



- 1 **Dr. Santanu Kumar Mishra**, Professor, ACES,
Dept. of Electrical Engineering, Indian Institute of Technology Kanpur



- 2 **Dr. Subhransu Ranjan Samantaray**, Professor,
School of Electrical Sciences, IIT Bhubaneswar



- 3 **Mr. Manmath Kumar Badapanda**, Scientific Officer-H, Raja Ramanna
Centre for Advanced Technology,
(Department of Atomic Energy, Government of India), Indore.



Engineering Section-VI (Electronics & Communication Engineering)



- 1 **Dr. Tapan Kumar Gandhi**, Professor,
Dept. of Electrical Engineering, IIT Delhi



- 2 **Prof. Subhananda Chakrabarti**, Professor,
Dept of Electrical Engineering, IIT Bombay

Engineering Section-VII (Aerospace Engineering)



- 1 **Prof. Sudarshan Kumar**, Institute Chair Professor and Head,
Department of Aerospace Engineering,
Indian Institute of Technology Bombay, Mumbai.



- 2 **Dr. Ravindra Kumar Tyagi**, Chairman,
BoG, Malaviya National Institute of Technology, Jaipur.



- 3 **Dr. K Rajalakshmi Menon**, Outstanding Scientist & Director,
Centre for Airborne Systems (CABS), DRDO
Centre for Airborne Systems, Bengaluru.

Engineering Section-VIII (Mining, Metallurgical and Materials Engineering)



- 1 **Prof. Monica Katiyar**, Professor and Head, Department of Materials
Science and Engineering, Indian Institute of Technology, Kanpur.



- 2 **Dr. Mukesh Kumar**, Senior Advisor,
JSP Group Advisory Services (JSPL Group), Gurugram.



- 3 **Dr. Dheepa Srinivasan**, Chief Engineer (Pratt & Whitney),
Pratt & Whitney R & D Center, Indian Institute of Science, Bangalore.



- 4 **Dr Sandip Ghosh Chowdhury**, Chief Scientist and Head,
Materials Engineering Division, CSIR-National Metallurgical
Laboratory, Jamshedpur.

Engineering Section-IX (Energy Engineering)



- 1 **Mr Rama Mohan N**, Executive Director.
(Engg. – Light Water Reactors),
Nuclear Power Corporation of India Limited, Mumbai



- 2 **Smt Smitha Manohar**, Outstanding Scientist & Director,
Nuclear Recycle Group, BARC, Mumbai



- 3 **Dr. Gopika Vinod**, Scientific Officer-H, Head,
Probabilistic Safety Section,
Reactor Safety Division, Bhabha Atomic Research Centre, Mumbai.

Engineering Section-X (Interdisciplinary and Special Engineering Fields and Leadership in Academia, R&D and Industry)



- 1 **Prof. Mannepalli Lakshmi Kantam**, Dr B. P. Godrej Distinguished
Professor of Green Chemistry and Sustainability Engineering,
Department of Chemical Engineering,
Institute of Chemical Technology, Mumbai



- 2 **Prof. Yashwant Gupta**, Distinguished Professor and Centre Director,
National Centre for Radio Astrophysics,
Tata Institute of Fundamental Research (TIFR), Pune



- 3 **Dr. Beena Rai**, Chief Scientist and Head,
Physical Sciences Research Area,
Tata Consultancy Services,
Tata Research Development and Design Centre, Pune.



- 4 **Dr. Gangadhar Rao Paruchuri**, Member BOG, NIPER, Guwahati,
Member, Board of Directors,
Bitchem Asphalt Technologies Pvt. Ltd., Hyderabad.

Newly elected Foreign Fellows



- 1 **Prof. Ranjith Nandakumara Pathegama Gamage**, Professor & Director,
Deep Earth Energy Laboratory, Monash University, Australia. (ES-I)



- 2 **Prof. Shree K Nayar**, T. C. Chang Chaired Professor,
Computer Science Department,
Columbia University, New York (ES-II)



- 3 **Prof. Ajay Kumar Dalai**, Distinguished Professor and Canada
Research Chair in Bioenergy and Environmentally Friendly Chemical
Processing,
University of Saskatchewan, Canada (ES-IV)



- 4 **Prof. Umesh Kumar Mishra**, Distinguished Professor,
University of California and Donald W Whittier Professor of ECE,
UC Santa Barbara: CTO and Chairman Transphorm Inc.,
USA (ES-VI)



- 5 **Prof. Ramamoorthy Ramesh**, Vice President for Research,
Rice University, USA. (ES-VIII).

Fellows elected under Rule 37(g)

With a view to enhance the visibility of INAE in Industry domain and also to increase industry representation in the Fellowship, upto five exceptional eminent persons from the Industry category are being elected as Fellows/ Foreign Fellows under the Rule 37(g) in a year since 2016.

This year, four eminent engineering luminaries elected as Fellows/Foreign Fellows under Rule37(g) were.



1 **Mr. Pratik Pal**, CEO of Tata Digital



2 **Dr. Mahesh Gupta**, Founder-Chairman of Kent RO Systems Ltd



3 **Dr. Ulrich L. Rohde**, Chairman, Synergy Microwave, NJ USA; Partner, Rohde & Schwarz, Munich, German Chair Office of the President, Dept. of R & D, Jt. Forces (DOD) Univ. of Munich, Germany, Professor, Brandenburg Univ. of Tech. (BTU), Cottbus, Germany Honorary Professor, Indian Institute of Technology, Delhi, India; Chair Honorary Professor, Indian Institute of Technology, Jammu, India.



4 **Mr. Sumant Sinha**, Chairman and CEO of ReNew Power



Honours and Awards

1	Prof BS Murty, FNAE, Director, IIT Hyderabad was conferred the “National Metallurgist Award 2021” on April 20, 2022 by the Hon’ble Minister of Steel at New Delhi. National Metallurgical Awards were instituted by Ministry of Steel to recognize outstanding contribution of metallurgical fraternity in Iron & Steel Sector covering the fields of manufacturing, Research & Development, academics etc.
2	Mr VN Heggade, FNAE, Chief Executive Officer (CEO), STUP Consultants Pvt. Ltd, Mumbai received the “OP Jain Memorial Structural Design Award – 2021 instituted by IIT Roorkee. He has also been selected as fib Fellow by the International Federation for Structural Concrete (fib). This distinction is given in recognition of his significant personal contributions to the work of the fib. The fib Fellow recognition will be presented during the opening ceremony of the 2023 Symposium in Istanbul on 5 June 2023. Mr VN Heggade also received that SB Joshi memorial award for excellence in Bridge & Structural Engineering instituted by COEP.
3	Prof Sudhir K Jain, FNAE, Vice-Chancellor, Banaras Hindu University, Varanasi and formerly Director and Professor of Civil Engineering, IIT Gandhinagar was conferred the Distinguished Alumni Award 2022 by California Institute of Technology, USA.
4	Prof Ranjan K. Mallik, FNAE, Institute Chair Professor and J. C. Bose Fellow Department of Electrical Engineering Indian Institute of Technology Delhi was selected by the Jury for award of the 2021 IEI-IEEE Award for Engineering Excellence for significant contributions applying advanced design and analysis of wireless communication and for enhancing the capabilities of mobile communication systems.
5	Prof Herbert Gleiter, Prof Dr Dr hcmult, KIT, Institut fur Nanotechnologie, Helmholtz, Germany was elected to be awarded the highly regarded Stookey Prize of Discovery for the year 2022. Moreover, the Chinese Academy of Science has decided to found - by the end of 2022 - a new and very large research center at Sheyang, the Herbert Gleiter International Laboratotry (HGIL). This center will focus its work on a new kind of non-crystalline solids, so called nanoglasses. It will have a size of about 600 scientists. The HGIL is designed to co-operate strongly with research laboratories within China as well as from abroad. Prof Gleiter is in contact with several colleagues from India to initiate co-operations of that kind between the HGIL and groups from India.
6	Prof Mahesh Tandon, FNAE, Managing Director, Tandon Consultants Pvt. Ltd., New Delhi has been awarded the Life Time Achievement Award for the year 2020 for his outstanding contributions for Highway Engineering profession by Indian Roads Congress. The award was conferred during the Inaugural Function of the 81st Annual Session held on October 8, 2022 at Lucknow.
7	Prof Suresh Bhargava, AM; FTSE, FNAE, FAAAS, FRSC, FRACI, FNASI, FTWAS-UNESCO, KIA Laureate and QPM Chair, Dean, Research & Innovation Research partnerships (India), Director for CAMIC, STEM College, RMIT University, Melbourne, Australia, a Foreign Fellow of INAE, received one of the Highest Civilian honours in Australia from the late Queen of England last year viz Member-order of Australia, Queens Honour, 2022.

8	Prof Suman Chakraborty, FNAE, Professor of Mechanical Engineering, Indian Institute of Technology Kharagpur was awarded the Infosys Prize 2022 for his contribution in the fields of Engineering and Computer Science. He was rewarded as his work helped advance healthcare in resource limited settings.
14	Prof K. Ramesh, FNAE, K Mahesh Chair Professor, Department of Applied Mechanics, IIT Madras, Chennai was selected to receive the “2023 M M Frocht Award” in recognition of outstanding achievements as an educator in the field of experimental mechanics by the Society of Experimental Mechanics, USA. The award ceremony will be on 7th June 2023 at their Annual conference to be held at Orlando, USA. For more details you can see the following link: https://sem.org/awardsfrocht
15	Prof AB Pandit, FNAE, Vice-President, INAE and Vice-Chancellor, ICT, Mumbai was elected as a Member of National Academy of Engineering, USA in recognition of his outstanding contributions to cavitation reactors from concept to commercialization, and engineering solutions to improve the lives of underserved people.
16	Prof RI Sujith, FNAE, D. Srinivasan Institute Chair Professor, Department of Aerospace Engineering, IIT Madras was elected as a Member of National Academy of Engineering, USA in recognition of his outstanding contributions in terms of applications of dynamical systems theory to the understanding and control of instabilities in engineering systems.
17	Dr. Ulrich L. Rohde, FNAE, Chairman, Synergy Microwave, NJ USA; Partner, Rohde & Schwarz, Munich, German Chair Office of the President, Dept. of R & D, Jt. Forces (DOD) Univ. of Munich, Germany, Professor, Brandenburg Univ. of Tech. (BTU), Cottbus, Germany was conferred the 2023 IEEE Communications Society Distinguished Industry Leader Award by the IEEE Communications Society.
18	Prof Gautam Biswas, FNAE, Professor and J C Bose National Fellow, IIT Kanpur and Formerly Director, CSIR-Central Mechanical Engineering Research Institute (CMERI), Durgapur; Formerly Director, Indian Institute of Technology Guwahati has been selected to receive the 2023 ASME Heat Transfer Memorial Award in the science category “for sustained and outstanding scholarly contributions to thermal science and engineering, including heat transfer enhancement, phase change heat transfer with and without electrohydrodynamic forces, and dynamics of liquid jet and droplet impingement” by the American Society of Mechanical Engineers (ASME). Formal presentation of the award will take place during the 2023 ASME International Mechanical Engineering Congress and exposition being held on October 29- November 3, 2023 in New Orleans, USA.



News of Fellows

1.	Dr. Debabrata Das, FNAE, Former Professor, Head and Renewable Energy Chair Professor, Department of Biotechnology, Former Professor-in-Charge, P K Sinha Center for Bioenergy, Indian Institute of Technology, Kharagpur was the Distinguished Speaker at Lecture Series on “next generation biofuel Phase 2” delivered offline in the Heritage Institute of Technology Kolkata during April 2022.
2.	Prof Ganti Prasad Rao, FNAE, Member UNESCO_EOLSS Joint Committee, Abu Dhabi, UAE delivered a Talk on “Unique features of Indian Knowledge Systems (IKS) on April 12, 2022 during a function organized by Centre of Excellence for India Knowledge Systems, IIT Kharagpur under the aegis of Azadi Ka Amrit Mahotsav Celebrations.
3.	Prof Sanjit K. Mitra, a Foreign fellow of INAE and Distinguished Professor Emeritus of Electrical & Computer Engineering, University of California, USA has been elected a member of the Academia Europaea.
4.	Dr. G. Satheesh Reddy, FNAE formerly Secretary DDR&D and Chairman DRDO, Ministry of Defence was appointed as Scientific Adviser to Raksha Mantri.
5.	Dr. Samir V. Kamat, FNAE formerly Distinguished Scientist and Director-General, Naval Systems & Materials, DRDO, was appointed as Secretary, Department of Defence Research and Development (DRDO).
6.	Prof M Balakrishnan, FNAE, Honorary Professor, CSE Department, IIT Delhi was inducted as an ACM Fellow during the last ACM Annual Award Ceremony.
7.	Prof. Sankar K. Pal, FNAE, National Science Chair, SERB, Govt. of India; ISI Emeritus Professor; Center for Soft Computing Research, Indian Statistical Institute, Kolkata has been elected as the President of Indian Statistical Institute (ISI) for the term 2022-2024 and also Member, European Academy of Sciences & Arts.
8.	Prof Yogesh M Joshi, FNAE, Department of Chemical Engineering, IIT Kanpur became the first Indian to be elected as a Fellow of the Society of Rheology.
9.	Prof Ganapati D. Yadav, FNAE, National Science Chair of Govt. of India and Emeritus Professor of Eminence, and Former Vice Chancellor of the Institute of Chemical Technology (ICT) Mumbai was elected as the Fellow of the US National Academy of Inventors (NAI). He is the only second Indian to be so honoured. The NAI was founded in 2010 to recognize and encourage inventors with patents issued from the U.S. Patent and Trademark Office, enhance the visibility of academic technology and innovation, encourage the disclosure of intellectual property, educate and mentor innovative students, and translate the inventions of its members to benefit society.



10.	Hon'ble Chief Minister of Karnataka, Mr Basavaraj Bommai released biography of Dr BN Suresh, Former President, INAE, Chancellor, Indian Institute of Space Science & Technology (IIST) and Honorary Distinguished Professor, ISRO Headquarters, Bangalore on October 29, 2022. The book authored by his son Mr Sunil Suresh tracks Dr. Suresh's journey from a small village called Hoskare near the town of Koppa to overseeing the development of India's launch vehicles.
11.	Dr Bhujanga Rao, Vepakomma, FNAE, ISRO Chair Professor, National Institute of Advanced Technologies (NIAS), Bengaluru was elected as Fellow of Indian National Science Academy (INSA) Effective from January 1, 2023 under a special category.
12.	Prof SN Mukhopadhyay, FNAE, Adjunct Professor, Department of Biological Sciences, BITS, Pilani and Former Professor, DBEB, IIT Delhi; Former Professor & Head, BERC, IIT Delhi; Former Professor SOBT, GBU, Greater Noida jointly with his wife Mrs Sakuntala had published a short paragraph in Bangla Medium with a title "Maner Majhe Mandir Mahima" in the Souvenir of Durgotsab 1429/year 2022 of C.R.Park, Kali Mandir Society in December 2022.
13.	<p>Prof M Packirisamy, FNAE, Professor & Concordia Research Chair, Director Micro Nano Bio Integration Centre, Concordia University, Canada has done breakthrough research on using sound waves for 3D printing of parts. It is the first time in world that it has been done. It was published in Nature Communications and covered throughout the world. It was selected as the Top10 Discoveries of Canada in 2022. Some links giving news on the research are given below.</p> <p>Direct Sound Printing in CBC with video: https://www.cbc.ca/news/canada/montreal/3d-printing-sound-waves-concordia-1.6718402</p> <p>CBC Radio Day Break Program; https://www.cbc.ca/listen/live-radio/1-15-daybreak-montreal/clip/15960717-concordia-researchers-honoured-work-printing-3d-objects-using</p>
14.	Dr. Sirshendu De, FNAE, Professor, Department of Chemical Engineering, IIT Kharagpur created an invention regarding arsenic removal technology which is placed in Top 100 Indian Innovations (2022). The book is available for online sale.
15.	Prof. Amitava Datta, FNAE was appointed as the Pro Vice-Chancellor of Jadavpur University, Kolkata.
16.	An authentic biography of 80-year journey of Dr. R.A. Mashelkar, FNAE, National Research Professor and Former Secretary, DSIR, Director General, CSIR, New Delhi; Former Chancellor, Academy of Scientific and Innovative Research (AcSIR) written by Dr. Sagar Deshpande was launched on 28th January 2023 at Pune.

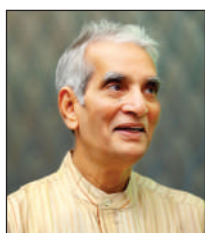


17.	Dr Sanak Mishra, FNAE, Immediate Past-President, INAE and Member of the Governing Board of the Steel Research & Technology Mission of India. Formerly Managing Director, Rourkela Steel Plant and Director, Steel Authority of India Ltd. (SAIL); Vice-President, ArcelorMittal and CEO India Projects; Secretary General, Indian Steel Association delivered a talk as Special Guest of the International Conference on “Reducing Carbon Footprint in Metal Industries” organized by The Indian Institute of Metals, Rourkela Chapter, in association with SAIL-RSP and NIT Rourkela, on February 03-04, 2023 at Rourkela.
18.	Prof SN Mukhopadhyay, FNAE, Adjunct Professor, Department of Biological Sciences, BITS, Pilani and Former Professor, DBEB, IIT Delhi; Former Professor & Head, BERC, IIT Delhi; Former Professor SOBT, GBU, Greater Noida received invitation to be an invited speaker in GMTOXI2023 conference to be held in Lisbon, Portugal on September 25-27,2023.
19.	<p>Prof DN Singh, FNAE, D.L. Shah Chair Professor for Innovation, Department of Civil Engineering, Indian Institute of Technology Bombay, Mumbai conducted an International workshop on Carbon Capture, Utilization, and Storage (CCUS).</p> <p>The YouTube videos are available at: Introductory Session https://youtu.be/udXwOTo7MZo Indian Industry & Concluding Session https://youtu.be/pa0TJ_zZR-A Foreign Partners https://youtu.be/NZvVm2ZyUFw</p>
20.	Dr. Naresh Chandra Murmu, FNAE, Chief Scientist & Head, Surf. Engg. & Tribology, CSIR-CMERI, Head, Business Innovation and Skills Division, CSIR-CMERI and Professor & Dean, Faculty of Engineering Sciences, Academy of Scientific and Innovative Research (AcSIR) was appointed as Director, CSIR-CMERI.

Fellows Deceased in Last one Year

During the year 2022-2023, it was learnt about the sad demise of the following INAE Fellows. Deepest Condolences have been expressed to the families of the deceased Fellows on behalf of INAE and prayers were offered for their souls to rest in peace. Brief Obituaries as a mark of respect for the departed INAE Fellows are given below.

Obituaries



Dr. T.S.R. Prasada Rao
(January 20, 1939 –April 7, 2022)

Dr. TSR Prasad Rao, FNAE, Chairman, Sarasi Jam Technologies, New Delhi and

Formerly Director, Indian Institute of Petroleum, born on January 20, 1939 passed away on April 7, 2022. He was elected to INAE Fellowship in the year 1993 and was affiliated to Engineering Section IV (Chemical Engineering).

Dr. TSR Prasada Rao had made outstanding contributions in developing mission-critical technologies that substitute processes available solely from multinational companies. His distinguished service to India was unique and notable because of his passionate and unrelenting efforts to go beyond the laboratory and apply science and engineering to develop and commercialise indigenous technologies for India's industrial development. His Key Word was Develop and Commercialise. He used his

science and engineering achievements to develop and commercialise more than 10 technologies in collaboration with leading Indian companies including Bharat Petroleum, Indian Oil, GAIL, Indian Petrochemicals, Reliance, and Cadila Pharmaceuticals. Similarly, Dr Rao led Indian Petrochemicals to acquire catalyst manufacturing capabilities, expanding India's position in the global catalyst manufacturing industry. Besides being an accomplished technocrat, Dr Rao was widely recognised as a successful leader of Indian R&D institutions. As Director of CSIR - IIP during 1990-1999, he combined his passion for science and engineering with his experience in industry to transform the institute from a sick laboratory to a vibrant, world-class innovation centre. Since retiring from Government sector in 1999, Dr. Rao had been passionately championed science-based entrepreneurship in India. He was a recipient of the INAE Life Time Contribution Award in Engineering for the year 2020.

May God bless his soul to Rest in Peace



Dr. AK Bhaduri
(August 28, 1959 - April 27, 2022)

Dr. AK Bhaduri, FNAE, Homi Bhabha Chair Former Director, Indira Gandhi Centre for Atomic Research, Kalpakkam born on August 28, 1959 passed away on April 27, 2022. He was elected to INAE Fellowship in the year 2007 and was affiliated to Engineering Section VIII (Mining, Metallurgical and Materials Engineering).

Dr. AK Bhaduri, who worked extensively on fast breeder reactors, served as the director of IGCAR, Kalpakkam, from July 2016 to August 2021. He was awarded the Raja Ramanna Fellowship post retirement. He completed his schooling from Calcutta Boys' School in 1978, and subsequently obtained B.Tech. (Hons.) in 1983 and Ph.D. in

1992, in Metallurgical Engineering from the Indian Institute of Technology, Kharagpur. He then joined the training school of Bhabha Atomic Research Centre at Trombay in 1983 and was awarded the Homi Bhabha Medal for topping the batch. Dr Bhaduri joined IGCAR in 1984 to become the Director of Metallurgy and Materials Group and also a Senior Professor of Homi Bhabha National Institute. He received the Humboldt Research Fellowship from the Alexander von Humboldt Foundation, Germany in 1994 and carried out post-doctoral research in University of Stuttgart, Germany for two years. He specialised in the field of materials welding, hardfacing and materials joining and has to his credit more than 220 journal publications, 360 conference presentations and two international patents.

May God bless his soul to Rest in Peace



Dr. S Varadarajan
(March 31, 1928- May 11, 2022)

Dr. S Varadarajan, one of the Founding Fellows and former President of INAE and Formerly Secretary to the Govt of India, Department of Science and Technology and Formerly Director General, CSIR born on March 31, 1928 passed away on May 11, 2022. He was elected to INAE Fellowship in the year 1987 and was affiliated to Engineering Section IV (Chemical Engineering).

In demise of Dr. Srinivasan Varadarajan at New Delhi, one of the leading chemists and among architects of Indian science was lost. He obtained his PhD (1952) from University of Delhi, and also from University of Cambridge, UK (1956). His early work was on benzopyrones and rotenoid natural plant products with biological effects. Starting career as Lecturer of Chemistry, Delhi University (1949-53), he availed of Exhibition Overseas Fellow with Sir Alexander Todd (1953-56) at Cambridge; Visiting Lecturer in Biology, Massachusetts Institute of Technology, USA (1956-57), Beit Memorial Fellow in Medical Research in Addenbrooks Hospital, Department of

Radiotherapeutics, University of Cambridge (1957-59). He returned to India in 1959 to initiate research in Hindustan Lever of the Unilever International Group with which he remained up to 1974.

Later, he was involved in research leading to the synthesis of nucleosides, nucleotides and to the structure of ribonucleic acid (RNA) phosphate linkage, through first cyclo-nucleoside with DM Brown and with Iodine labelled heavy atom and first application of X-ray crystallography in the Laboratory of Sir Lawrence Bragg. His research at the Biology Department of MIT yielded uniformly ^{14}C labelled *Thiobacillus denitrificans* and *Escheria coli* deoxynucleotides, converted to triphosphosphates chemically and isolated through first use of lithium bromide, as precursors for biosynthesis of DNA.

During 1975 and 1983, Dr Varadarajan became Chairman of several public sector organisations also. He worked as Secretary to Government of India (1982-88) in the Department of Science and Technology (DST) and was Director General, Council of Scientific Industrial Research (CSIR), and many others. Dr Varadarajan was an efficient manager. He was a Founder Member of the Government Oil Industry Development Board (OIDB) since 1973. He was invited to be Member

of Oxford Energy Policy Club, St Anthony's College (1976-83). He has been associated with management of many prestigious institutions like IIM-A; National Council of Applied Economic Research (1976-84), IIT, IISc, Indian Institute of Science, JNU and BHU. He was Trustee of Indira Gandhi National Centre for Arts. He served for 11 years as Chairman of National Commission of Science Museums and assisted in establishment of several Science Museums during 1975-86. He was Member of Public Enterprises Selection Board (1985-88). He was associated with international negotiations for establishment of International Centre for Genetic Engineering and Biotechnology in Delhi and Trieste, and the formation of Indo-French Centre for Advanced Scientific Research in Delhi. Special mention may be made of his work completed on Environmental effects of Refinery on Taj Mahal Monuments (1974-76) and again (1994-95) and on safe disposal of highly toxic stored materials after gas leakage at Bhopal in December 1984. Dr. Varadarajan had been President of INSA (1996-98), Indian Academy of Sciences, Bangalore (1980-82), Indian National Academy of Engineering

(1992-95), Nutrition Society of India (1982-86), Oil Technologists Association of India (1984-86) and Treasurer Materials Research Society of India (1990-94). He was Member of International Committee of ICSU on Chemical Research Applied to World Needs (CHEMRAWN); the small India-Japan Eminent Persons Group of Governments and the INSA-Japan Science Advisory Council.

He was also elected Fellow of the all three Science Academy of India; Academy of Sciences for the Developing World (TWAS), and also National Academy of Agricultural Sciences of India, Society of Engineers, All India Management Association, and Jawaharlal Nehru Centre for Advanced Scientific Research. He received CV Raman Medal, INSA Medal for Promotion of Science (2004), and occupied Platinum Jubilee Chair for Promotion and Service to Science (2009-2014). He was conferred the Padma Bhushan from President of India; INAE Lifetime Contribution Award in Engineering in the year 2003 and Life Time Science Award in Petroleum.

May God bless his soul to Rest in Peace



Dr. Jamshed J Irani
(June 2, 1936- October 31, 2022)

Dr. Jamshed J Irani, FNAE born on June 2, 1936 passed away on October 31, 2022.

Dr. Jamshed J Irani, Formerly Managing Director, Tata Steel was also known as the steel man of India. He was associated with Tata Steel for over four decades when he decided to retire from the board committee in June 2011, leaving behind a legacy that earned him and the organisation several international and national acclaim. He attended Science College and Nagpur University to pursue BSc and MSc in Geology. Later, he shifted to the United Kingdom to attend the University of Sheffield as a JN Tata Scholar, where he completed a Master's in Metallurgy and a PhD in Metallurgy. He started his professional career by joining Sheffield's British Iron and Steel Research Association. While working in a British company, he always yearned to contribute to India's development. After five years in Britain, he

returned to his homeland and joined Tata Steel (then The Tata Iron and Steel Company) as an Assistant to the Director in charge of Research and Development (R&D). He became the company's General Manager in 1979, the President of Tata Steel in 1985 and the Managing Director in 1988. He joined the company as a Non-Executive Director in 2001, which continued for a decade. Besides Tata Sons and Tata Steel, he also held positions at several Tata Group companies- Tata Teleservices and Tata Motors. As an industrialist, Dr. Irani was conferred with several honours, including his appointment in the Royal Academy of Engineering as an International Fellow and an Honorary Knighthood by Queen Elizabeth II for his contributions to Indo-British trade and cooperation. Dr. Irani also served as the national president of the Confederation of Indian Industry for 1992-93. He was conferred the INAE Life Time Contribution Award in Engineering in the year 2002 and the Padma Bhushan in 2007 by President of India for contributing to the country as an industrialist.

May God Bless his soul to Rest in Peace



Mr. Vikram S Kirloskar
(November 19, 1958 -
November 29, 2022)

Mr. Vikram S Kirloskar, FNAE born on November 19, 1958 passed away on November 29, 2022. He was elected to INAE Fellowship in the year 2021 and affiliated to ES -III (Mechanical Engineering).

Mr. Vikram S Kirloskar, Chairman and Managing Director of Kirloskar Systems Ltd. & Vice Chairman of Toyota Kirloskar Motor obtained his Bachelor's in Science in Mechanical Engineering from MIT, USA in 1981. He was responsible for partnering the Toyota Group and starting a major automobile manufacturing industry in Karnataka; for which

he conferred with "Suvarna Karnataka" award by Government of Karnataka. He had designed and developed many processes and machine tools in his career. Mr Kirloskar was a staunch advocate of green mobility solutions. According to him, it was crucial to align technology with the energy mix and the infrastructure available to cut emissions in a world grappling with the fallout of climate change. He was President of Confederation of Indian Industry (CII) during 2019-20 and was conferred with Indian Institute of Metals JRD Tata Award 2020, for his excellence in corporate leadership in Metallurgical Industries. Mr. Kirloskar had made seminal contributions in promotion of the growth of the Indian industry.

May God Bless his soul to Rest in Peace



Mr. VCV Chenulu
(December 01, 1931 -
December 1, 2022)

Mr. VCV Chenulu, FNAE born on December 1, 1931 passed away on December 1, 2022. He was elected to INAE Fellowship in the year 1990 and affiliated to ES - V (Electrical Engineering).

Mr. VCV Chenulu, Formerly Member (Electrical), Railway Board, Indian Railways held various important appointments in Indian Railways such as Assistant Electrical Engineer, Chief Electrical Engineer; Director General (Research, Designs &

Standards Organization) and as the first Member (Electrical) Railway Board. As Member (Electrical), he made significant contributions in development of proper infrastructure for discharging the responsibility of reliable and efficient operation and maintenance of Electrical assets under his charge. In the modernization plans, acquisition of three phase high horsepower electric locomotives was a major step, under his guidance. The Research Designs and Standards Organisation (RDSO) and the Chittaranjan Locomotive works also successfully upgraded the designs and improved reliability, under his tenure.

May God Bless his soul to Rest in Peace



Dr. SJ Chopra
(April 29, 1941 –
November 23, 2022)

Dr. SJ Chopra, FNAE born on April 29, 1941 passed away on November 23, 2022. He was elected to INAE Fellowship in the year 2006 and affiliated to ES - IV (Chemical Engineering). Dr. SJ Chopra, Founding Chancellor, University of Petroleum & Energy Studies (UPES), Dehradun had also served as Visiting Professor at IIT Delhi and IIT Roorkee. He was an institution builder and had made outstanding

research contributions in Chemical Engineering particularly in Oil & Gas sector. Earlier he served as Director (Technical), Engineers India Limited and was also Chairman & Managing Director for a short duration. At UPES, he laid a futuristic pathway for education and played a nurturing role for the progress of the Institution which envisions itself as an institution of global standing, which fosters development of professionally-competent talent and contributes to nation-building.

May God Bless his soul to Rest in Peace



Prof. Pravina P Parikh
(January 14, 1941 –
March 14, 2023)

Prof. Pravina P Parikh, FNAE born on January 14, 1941 passed away on March 14, 2023. She was elected to INAE Fellowship in the year 1996 and was affiliated to Engineering Section III (Mechanical Engineering). Prof Parikh, Professor Emeritus and formerly Professor, Department of Mechanical Engineering, IIT Bombay was one of the first - generation experts of India in the areas of Alternate Fuels, Biomass Gasification, Emissions & CNG vehicles,

IC Engines & Combustion and Thermal & Fluids Engineering. She mentored many women scientists, who have stepped into the area of Auto/IC Engines. She was in-charge of the IC Engines Lab for a long period and developed engines and used alternate fuels for them, duly modifying the engines. She was an accomplished Academician who made significant R&D contributions and also contributed to the growth of the Mechanical Engineering Department of IIT Bombay. She did a DST project on “status of lady engineers in India”; which was the largest project on this topic in India, at that time.

May God Bless her soul to Rest in Peace



INAE Annual Convention 2022

INAE Annual Convention 2022 was held on December 14-16, 2022 at Bhabha Atomic Research Centre (BARC), Mumbai in physical mode. The Inaugural Session was held on December 14, 2022. The Welcome Address was delivered by Dr AK Mohanty, FNAE, Director, BARC. Prof Indranil Manna, President, INAE delivered the Presidential Address. Two Compendiums on “Women Engineers in India Vol. I” and “Landmark Achievements in Engineering and Technology in Independent India” prepared by INAE under the aegis of the Azadi ka Amrit Mahotsav celebrations were released. INAE Study Report on “Housing in India – Challenges & Way Forward” was also released by the dignitaries on the dais during the Inaugural Session. The Session featured an enlightening Address by the Distinguished Guest - Dr. R Chidambaram, FNAE, Chairman (Honorary), School for Advanced Studies in Nuclear Science & Technology, BARC and Former PSA to Govt. of India. The Inaugural Lecture was delivered by the Chief Guest - Mr Nadir B Godrej, FNAE, Managing Director-Godrej Industries Ltd. and Chairman, Godrej Agrovet Ltd., Mumbai, who also delivered the Keynote Address. The INAE Governing Council Meeting was held in the evening of December 14, 2022.



Release of Compendium on
“Women Engineers in India Vol. I”



Release of INAE Study Report on “Housing in India –
Challenges & Way Forward”



Release of Compendium on “Landmark Achievements in Engineering and Technology in Independent India”



Dr. AK Mohanty, Director, BARC
delivering Welcome Address



Prof. Indranil Manna, President, INAE
delivering Presidential Address

Highlights of the Inaugural Session on December 14, 2022



Keynote Address by Mr Nadir B Godrej, FNAE,
MD-Godrej Industries Ltd. & Chairman, Godrej
Agrovet Ltd., Mumbai

A special presentation on DAE-BARC Technology for Society was organized in the morning of December 15, 2022 wherein the achievements of BARC and applications of Nuclear technology

in the societal domain were showcased. Two Special Sessions on Compendiums by INAE, viz., “Women Engineers in India Vol. I” and “Landmark Achievements in Engineering and Technology in Independent India” were held on December 15, 2022, which were presided by Prof Indranil Manna, President, INAE, wherein the Committee Members participated and shared their experiences on the journey of preparing the documents.

There were four Plenary Talks during the Convention viz. on “Atmanirbharta in Defence” by Mr. JD Patil, Member of Executive committee of Management Larsen & Toubro, and Advisor Defence & Smart Technologies to CEO & MD Larsen & Toubro; on “Energy Security and Sustainability: International Cooperation to Solve a Global Problem” by Prof John L Anderson, President, US National Academy of Engineering, (Pre-recorded); on “Role of Nuclear Energy in Climate Change” by Mr BC Pathak, CMD, NPCIL and on “Building Greater Futures with Innovation and Collective Knowledge” by Mr. K Ananth Krishnan, EVP & CTO, TCS, Chennai. These talks by eminent engineering luminaries held the distinguished audience spellbound.



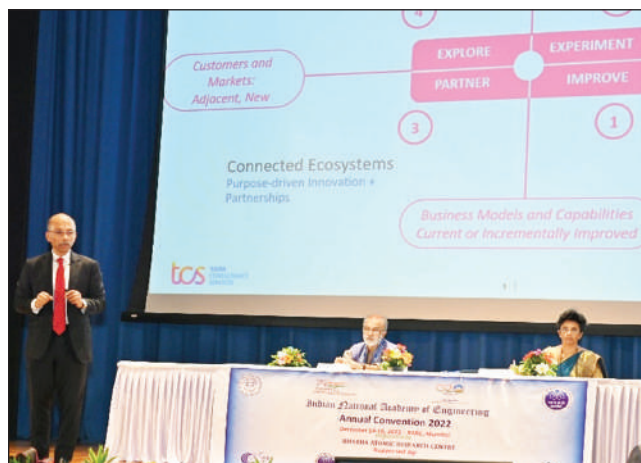
Plenary Talk by Mr. JD Patil, Member of Executive committee of Management Larsen & Toubro, and Advisor Defence & Smart Technologies to CEO & MD Larsen & Toubro



Pre-Recorded Plenary Talk by Prof John L Anderson, President, US National Academy of Engineering



Plenary Talk by Mr BC Pathak, CMD, NPCIL



Plenary Talk by Mr. K Ananth Krishnan, EVP & CTO, TCS, Chennai

The Technical Presentations by newly elected Fellows and Young Associates were conducted in three Parallel Sessions on December 15, 2022 which were appreciated by the august audience. The Annual General Meeting (AGM) of Fellows and Induction Ceremony of newly elected Fellows & Young Associates were held on December 16, 2022. The Convention concluded with the BARC Facility Visit / Electron Beam Centre & BRIT tour on December 16, 2022. About 180 INAE Fellows and Young Associates participated in the Convention which was well appreciated by all the INAE Fellows and Delegates.

INAE Publications

(i) Transactions of Indian National Academy of Engineering – An International Journal of Engineering and Technology”

INAE is currently publishing a Journal named “Transactions of Indian National Academy of Engineering – International Journal of Engineering and Technology” published by M/s Springer which was earlier named INAE Letters. The following issues were brought out during the year:

- Transactions of INAE Volume 7, Issue 2, June 2022
- Transactions of INAE Volume 7, Issue 3, September 2022
- Transactions of INAE Volume 7, Issue 4, December 2022
- Transactions of INAE Volume 8, Issue 1, March 2023

(ii) Compendium on “Women Engineers in India Vol. I”

The Government of India launched a 75-week celebration of India’s 75th year of Independence (Azadi Ka Amrit Mahotsav) in March 2021 and Department of Science and Technology (DST), Government of India requested all Autonomous bodies under its aegis to conduct technical programmes and activities to mark the celebrations. It was thus envisaged in June 2021 to bring out a Compendium on “Women Engineers in India- Volume I” as no such document is available anywhere. This initiative of publishing a compendium on “Woman Engineers in India-Volume I” assumes added importance primarily as the ratio of eminent women professionals in engineering compared to their male counterparts is rather insignificant and secondly, because no authentic database or source is available in the country that documents the contributions of woman professionals and scholars in engineering and technology in the leadership role. Gender parity is absolutely essential for our country not only to accelerate economic growth and societal balance, but also to harness the demographic dividend of the large and very young population of India.

To realize this noble ambition, a detailed exercise was undertaken wherein Heads of Academic institutions, R&D Organization and Industrial Houses were requested to nominate deserving women engineers for inclusion in this Compendium. An Editorial Committee was constituted under the Chairmanship of Prof Purnendu Ghosh, Vice-President, INAE to undertake the task. Periodic meetings of the Editorial Committee were held with active and sustained contributions of all Members. A Master List of nominees based on suggested names of women engineers was prepared with inputs received from the Members of the Editorial Committee and Heads of Academic Institutions, R&D organizations and Industry in response to letters from President, INAE and the nominees for this volume were chosen by adopting laid down yardsticks and criteria. The nominations received were scrutinized by the Editorial Committee based on a set of guidelines laid out for selection of the worthiest nominees through wide and multi-tier consultation for inclusion of their contributions in the compendium.

The contributions of seventy-five nominees finally shortlisted are contained in this compendium which it was hoped shall meet the objectives of felicitating the eminent women engineers as well as

inspiring bright women talents in the country to take up engineering as their future professional goal. The selection in this compendium was neither beyond question nor the final. This exercise was not intended only to choose the champions, but to highlight the most eminent women engineers who championed engineering in different era despite all odds and hence could serve as the role models worth emulating by the future generations. This volume was seen as a sincere endeavour to showcase a selected few women-engineers who made seminal contributions in engineering and technology that were as eminent and important as that made by the male counterparts of their time.



National Release of Compendium on “Women Engineers in India- Volume I” during National Science Day Celebrations 2023

Messages from Dr Jitendra Singh, Hon’ble Minister of State (Independent Charge) for Science and Technology and Earth Sciences and Dr. Srivari Chandrasekhar, Secretary, Department of Science and Technology (DST), Govt. of India are featured in the Compendium on “Women Engineers in India Vol. I”. INAE firmly believed that publishing a comprehensive and attractive compilation of the most illustrious women engineers of the country will surely encourage many young girls to choose engineering as a career option and dedicate themselves in making engineering a viable tool to boost the country’s record in innovation and standing as a global technological superpower in due course.

Hard copies of the Compendium “Women Engineers in India- Volume I” had been presented to the Editorial Committee; women engineers featured in the Compendium and several Government officials such as Shri Thaawarchand Gehlot, Hon’ble Governor of Karnataka; Smt Smriti Irani, Hon’ble Union Cabinet Minister for Women & Child Development and Minority Affairs; Dr Sanjeev Sanyal, Principal Economic Advisor to the Government of India; Shri Rajiv Gauba, Cabinet Secretary; Prof AK Sood, PSA to Govt. of India; Prof TG Sitharam, Chairman, AICTE; DST Officials; Prof. M. Jagadesh Kumar, FNAE, Chairman, UGC; Dr G Satheesh Reddy, FNAE, Scientific Advisor to Rakhsha Mantri, Govt. of India; Secretaries of Strategic Departments viz Dr KN Vyas, FNAE, Secretary, DAE and Chairman, Atomic Energy Commission; Dr SV Kamat, FNAE, Secretary, Department of Defence R&D and Chairman, DRDO and Mr S Somanath, FNAE, Secretary, DoS and Chairman, ISRO and other officials. A Message from the Hon’ble Governor of Karnataka was received lauding the initiative of the Academy.



Dr Tessy Thomas, FNAE and Ms Nazneen Banu, presenting a copy of the Compendium on “Women Engineers in India- Volume I” to Governor of Karnataka- Shri Thaawarchand Gehlot



Prof Indranil Manna, President, INAE presenting copy of Compendium on “Women Engineers in India Vol 1” to Smt Smriti Irani, Hon’ble Union Cabinet Minister for Women & Child Development and Minority Affairs

(iii) Compendium on “Landmark Achievements in Engineering and Technology in Independent India”

The Compendium on “Landmark Achievements in Engineering and Technology in Independent India” was also compiled by the INAE as a part of the 75-week celebration of India’s 75th Year of Independence (Azadi ka Amrit Mahotsav) to showcase the country’s seminal achievements in this domain. In order to diligently pursue the onerous task of documenting the most significant engineering and technological achievements of the country in the last 75 years, a Task Force was constituted under the chairmanship of Prof. Prem Krishna, a former Vice President of INAE to steer this project with representative experts from each of the ten Engineering Sections of the Academy. The Task Force solicited inputs from the entire Fellowship and resources available throughout the country. Suggestions and nominations for entry into the compendium were thus invited from the major industries, strategic Departments, national institutions, R&D Organizations besides Fellowship of INAE, INAE Young Associates, students, professionals and top organizations. The topics were chosen based on well-defined criteria and after due deliberations by the Task Force Members. A Master list of over 750 items was created after several revisions before the final selection of the 75 entries distributed into eight groups were identified by the Members of the Task Force based on the five criteria, namely, benefit to the society/country/industry sector, significance of the engineering feat, impact of contribution with respect to number of people benefitted, uniqueness and novelty, and technological leadership. Engineering is meant to designing and providing solutions to societal aspiration and hence the usefulness of the contribution to the masses was given due importance in selection of the landmark achievements. The initial list allocated of over 750 items were allocated into 16 sector areas was reduced to the desired number of 75, divided into 8 groups. The eight groups are Energy, Infrastructure, Communication, Digital, Systems, Chemicals & Materials, Food & Healthcare and Aerospace. While it is to be expected that all the items included in this volume constitute landmark achievements, it is reasonable to state that there are many which could not cross the line and get included, because the number was limited. The articles pertaining to the eight sectors are preceded by a brief on INAE and an article on engineering education. Members of the Task Force representing the corresponding Engineering Sections, along with 3-5 champions co-opted by each, were requested to prepare the write-ups, guided by a given format.



It was noted that the engineering solutions are seldom unique, especially considering the geography, resources, timeframe, economic and political backdrop. Hence, the selection of 75 landmark achievements in this compendium can neither be unique nor beyond question. Suffice to say that the intention here was not to examine the superiority but to emphasize the importance and impact of such engineering feats that certainly made a huge difference to the quality of life and technological progress of the nation. In other words, the endeavour was aimed more to showcase such engineering success that would inspire many more and even bigger success in engineering and technology in the future. The compendium was realized because of the contributions from Fellows and Heads and Members of Corporate Bodies, Strategic Sectors, Academia, and R&D organizations. Messages from Dr Jitendra Singh, Hon'ble Minister of State (Independent Charge) for Science and Technology and Earth Sciences and Dr. Srivari Chandrasekhar, Secretary, Department of Science and Technology (DST), Govt. of India are featured in the Compendium on “Landmark Achievements in Engineering and Technology in Independent India”.



National Release of Compendium on “Landmark Achievements in Engineering and Technology in Independent India” during National Science Day Celebrations 2023

Hard copies of the Compendium were presented to the Task Force Members; Dr Sanjeev Sanyal, Principal Economic Advisor to the Government of India; Shri Rajiv Gauba, Cabinet Secretary; Prof TG Sitharam, Chairman, AICTE; DST Officials; Prof. M. Jagadesh Kumar, FNAE, Chairman, UGC; Dr G Satheesh Reddy, FNAE, Scientific Advisor to Rakhsha Mantri, Govt. of India; Secretaries of Strategic Departments viz Dr KN Vyas, FNAE, Secretary, DAE and Chairman, Atomic Energy Commission; Dr SV Kamat, FNAE, Secretary, Department of Defence R&D and Chairman, DRDO and Mr S Somanath, FNAE, Secretary, DoS and Chairman, ISRO and other officials. Prof M Jagadesh Kumar tweeted “INAE brought a Compendium on “Women Engineers in India Vol. I” and another on “Landmark Achievements in Engineering and Technology in Independent India.” He presented a copy of both books’ worth reading by the University community. Look forward to working with INAE.”



Prof Indranil Manna, President, INAE presenting copies of Both Compendiums to Prof M Jagadesh Kumar, Chairman, UGC

(iv) INAE Report of Committee on “Technological Preparedness for Dealing with National Disruptions”

An important initiative undertaken by the Academy under the aegis of the Azadi ka Amrit Mahotsav celebrations in bringing out a Report of Committee on “Technological Preparedness for Dealing with National Disruptions”. India is prone to many natural and man-made disasters and INAE taking note of unprecedented Covid Pandemic, felt that there is a need to enhance the technological preparedness of the nation to face these national disruptions/disasters of different types and formulate engineering interventions to cope with to such calamities. Therefore, a number of committees with domain specialists with the primary aim to examine technology preparedness of the country to face such exigency was undertaken, overseen by a Peer Committee chaired by Dr PS Goel, former President, INAE and Formerly Secretary, Ministry of Earth Sciences and Chairman, Earth Commission and Director, ISRO Satellite Centre, Bangalore.

The following six domain were identified, and expert committees were constituted viz. Weather and climate related disasters; Ocean related disasters; Geological related disasters; Health related disasters; Cyber security related disasters and Fire related disasters. Each expert committee had several meetings within themselves and across the expert committees as some of them have overlapping activity. Peer committee had several interactions with each expert committee primarily to steer the studies towards what kind of engineering preparedness the country needs to create in terms of basic science, tools & gadgets, instruments, equipment, communication & connectivity etc. The expert committees were also advised to address policy issues and any new mechanism or bodies that need to be set up in the country.

This report was an outcome of this exercise. The recommendations outlined in each expert committee report had focused on implementable aspect and create additional mechanisms, where needed. There is no claim that these would solve all problems related to disasters, but certainly, if accepted and implemented, the country would be better prepared to face the national disasters in the future. This report is organized in two parts. The part I gives this the consolidated recommendations emerging from the 6 expert committees and the discussions in the Peer committee, organized as per the agencies responsible for the engineering preparedness, namely the agencies and departments of the GoI. Some of the recommendations have been repeated against more than one agency. It is



because one agency may be user while other may be provider. It is recognized that NDMA is the prime body responsible for providing immediate relief on the ground, however we need additional mechanism(s) to organize the engineering preparedness and practically all S&T agencies are involved in this activity. Part II of the report gives the study and recommendations of the 6 expert committees. These studies are the basis of this report but should not be seen in isolation. A lot of interaction has taken place, where necessary, within the expert committees and the peer committee. Finally, the overall recommendations have attempted to provide an integrated approach to the engineering preparedness for Disaster Management. The report of Committee on “Technological Preparedness for Dealing with National Disruptions” details the exercise of understanding the sources and nature of such disasters, identifying the gaps and recommending the engineering/technological solutions to be implemented by various agencies. It is believed that once these recommendations are implemented, the country would be better prepared to face these disasters, natural or manmade, in dealing with and reducing loss of life and property.



Release of INAE Report of Committee on “Technological Preparedness for Dealing with National Disruptions” during National Science Day Celebrations 2023

INAE Compendiums on “Women Engineers in India Vol 1” prepared by the Editorial Committee under the Chairmanship of Prof Purnendu Ghosh, former Vice-President, INAE and “Landmark Achievements in Engineering and Technology in Independent India” prepared by the Task Force under the Chairmanship of Prof Prem Krishna, former Vice-President, INAE; both prepared under the aegis of the Azadi ka Amrit Mahotsav celebrations of the Government of India and published by Vigyan Prasar were released by the Chief Guest, Dr Jitendra Singh, Hon’ble Minister of State (Independent Charge) for the Ministry of Science and Technology & Earth Sciences during the National Science Day Function 2023 organized by DST, Govt. of India at Vigyan Bhawan on February 28, 2023 in presence of the PSA to Govt. of India Prof. Ajay Kumar Sood; Prof K VijayRaghavan, former PSA to Govt. of India; Dr S Chandrasekhar, Secretary, DST and other dignitaries. The INAE Report on of Committee on “Technological Preparedness for Dealing with National Disruptions” prepared under the Chairmanship of Dr PS Goel, former President, INAE was also released by the Hon’ble Minister during the Function.

The YouTube link for viewing the function is <https://www.youtube.com/watch?v=Z-FFeq4dP2o>

(v) Study Report on “Housing in India – Challenges & Way Forward”

The report on Study on “Housing in India – Challenges & Way Forward” incorporating all inputs from invited experts was released during the INAE Annual Convention 2022 held on December 14-16, 2022 at Bhabha Atomic Research Centre (BARC), Mumbai. Civil Infrastructure touches the lives of millions, and thus the reduction or removal of its deficiencies create an enormous challenge. The Academy therefore set up the forum on Civil Infrastructure in January 2018 to address the issues of Traffic & Transportation, Housing and Water in the context of National Development. The study on Housing problems in India contained in this report has been carried out by authors with considerable experience and expertise in the subject domain drawn from within the INAE Fellowship as well as other eminent experts. The report contains an analysis of the challenges faced and their possible solutions and, contains a set of actionable - recommendations. Before its finalization, an extended executive summary based on the draft was shared with a select group of stakeholders in the domain, and also discussed subsequently in an online meeting, wherein besides invited experts, officials from the Ministry of Housing & Urban Affairs, Government of India, also participated. The comments from the stakeholders, experts and officials served as valuable inputs for finalizing the report and helped in making it more meaningful and relevant. The report on Study on “Housing in India – Challenges & Way Forward” is being disseminated to the concerned stakeholders from the Government agencies, besides INAE Fellows and other experts for follow up actions on the recommendations accordingly.



Donations to INAE Corpus Fund

INAE is presently facing crisis for its sustenance following the notification served by the Department of Science and Technology (DST) on 6th May 2022 conveying the direction of the Department of Expenditure, Government of India (GoI) that the Government would disengage itself from the activities of INAE including discontinuing the annual financial support w.e.f. 31st March 2025 as intimated vide DST letter dated June 24, 2022. In the wake of the DST's decision to stop funding to INAE w.e.f. 1.4.25, INAE has been making concerted efforts to reach out to various high-level Government officials and others, to convince and reconsider decision of disengagement. In addition, parallel efforts to evolve a strategy and action plan to ensure sustainability and financial and functional autonomy are also being made by INAE.

Prof. Indranil Manna, President, INAE vide letter dated March 29, 2023 addressed to the Fellowship recalled that the Department of Science and Technology (DST), as directed by the Department of Expenditure, Government of India (GoI) is in the process of disengaging itself from the activities of INAE including providing the annual financial support w.e.f. 31st March 2025. He also highlighted that to address the issue of sustainability of INAE, we had several meetings with high level Government officials, former Presidents and senior Fellows of INAE, and industry leaders in the last 10 months since the formal letter from DST was served to INAE about disengagement. While efforts would continue to impress upon the Government that INAE is essential to realize the country's agenda on engineering and technology, it is now amply clear that INAE must undertake a serious effort to generate an adequate Corpus Fund and attain financial self-sufficiency. He further brought out that Engineering is all about evolving viable solution to prevailing or future challenges and aspirations. Hence, the present crisis may be viewed as an opportunity for INAE to emerge stronger and more resolute to fulfil its core objective of serving the profession and the nation in a more comprehensive manner. He hoped that each Fellow would agree that the onus of confronting the current crisis and eventually winning over can rest neither on a few office bearers nor only on a nominated committee. If INAE has to tide over this unprecedented and most unfortunate crisis, every single Fellow, Associate, Awardee and mentor of INAE must come forward and make a useful and decisive contribution.

After sustained efforts, INAE has been given the approval by the Competent Authority for the creation of a new corpus fund from INAE's own resources (internal accruals) in accordance with the Rule 229 (iv) & (v) of General Financial Rules (GFR), 2017 of the GoI on 24th March 2023. Contributions have since been received for INAE Corpus Fund from INAE Fellowship and the process is ongoing. The details for forwarding of donations and tax benefits to donors are given below:

Bank Details for receipt of donation to INAE:

Name of beneficiary: **INAE Corpus Fund**, Account Number: **41790835603**
Bank Address: **Jawaharlal Nehru University, New Mehrauli Road, New Delhi**
Type of Account: **Savings**, IFSC: **SBIN0001624**

Tax benefits for donors

The contribution to the INAE Corpus Fund qualifies to be considered under the category of donation and is eligible for 50% tax deduction under section 80G. The donors will get a receipt and the 80G certificate within a fortnight. INAE is extremely grateful to all Fellows who have generously contributed to the INAE Corpus Fund and welcomes further contributions/donations from Fellows, Young Associates, Awardees; Industry Leaders and Industry Houses etc with a view to achieving self-sufficiency in functioning in the near future.



Miscellaneous News of INAE

Vigilance Awareness Week Celebrations by INAE

The Vigilance Awareness week was observed at INAE from 31st October to 6th November 2022 at INAE. The theme was based on “Independent India@75: Self Reliance with Integrity”. In order to create awareness among the employees, various activities were organized at INAE such as quiz competition etc. To highlight the importance of following ethical practices in all sphere of life, a talk was delivered by Lt Col Shobhit Rai (Retd), Deputy Executive Director, INAE wherein he highlighted that the Central Vigilance Commission has the mandate under the Central Vigilance Commission Act, 2003 to fight corruption and to ensure integrity in public administration. A buzz was also created on INAE social media platform, INAE website, notice board etc to mark the event.

Training of INAE Staff - Training Session on “Cyber Hygiene”

A training session on “Cyber Hygiene” was organized for INAE Staff on May 8, 2022 at New Delhi which was presided by Lt Col Shobhit Rai (Retd), Officiating Executive Director, INAE. This session was held in response to the directive of Ministry of Home Affairs who launched the India Cyber Crime Coordination Centre to strengthen the capabilities of Law Enforcement agencies in the country and requested all offices and Autonomous Bodies to generate awareness on cyber hygiene in office functioning. During the session, the Staff were briefed on various aspects related to cyber hygiene and were advised on the checks and balances to be taken on tackling of potential cyber threats including hacking and receipt of spam mail.

Vigilance Training Programme

Training programme in Administrative Vigilance was conducted by the Department of Science & Technology from 19th October – 21st October 2022 for Vigilance Officers dealing with vigilance/disciplinary matters. This training programme was attended by Mr. Virender Kumar Valyat, Senior Manager, INAE, a nominated person from INAE. The aim of this training session was to provide knowledge to function as Vigilance Officer and to develop the skill required for Inquiry Officers and Presenting Officers.





Statement of Accounts

2022-23



Indian National Academy of Engineering





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Independent Auditor's Report

To
The Members
Indian National Academy of Engineering
Technology Bhawan,
New Delhi-110016

Opinion

We have audited the financial statements of **M/s Indian National Academy of Engineering**, which comprise the balance sheet at March 31st 2023 and also the income and expenditure account for the year then ended and notes to the financial statements, including a summary of significant accounting policies.

In our opinion, the accompanying financial statements give a true and fair view in accordance with the accounting principles generally accepted in India of the financial position of the entity as at March 31, 2023 and of its excess of income over expenditure for the year ended of that date.

Emphasis of matters

We draw attention to note number 1 of Schedule 25 of the financial statements, which describes that during the year the office of Principal Director of Audit (Environment & Scientific Division) conducted an inspection on compliance audit for the period from 2017-18 to 2021-2022. The report majorly indicates the following liabilities which may devolve on the Trust:

- i. Rs. 8.87 crores lying under corpus fund & General fund with INAE in contravention to the directions for the creation of such funds by Government of India.
- ii. Rs. 26.12 lakhs lying unspent with Digital Knowledge Resource Centre (DKRC) Fund, not created with due approval.

The Academy has decided to examine the observations provided in the matters mentioned in the inspection report. Our opinion is not modified in respect of this matter.

Basis for Opinion

We conducted our audit in accordance with the Standards on Auditing (SAs) issued by ICAI. Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are independent of the Society in accordance with the ethical requirements that are relevant to our audit of the financial statements in [jurisdiction], and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

P. K. Gaur & Associates, a Partnership Firm with Registration No. 005311N
Regd. Office : Suite #4G, Uppal's M6 Plaza, Jasola District Center, New Delhi - 110025, Branches : Kanpur, Noida, Kolkata





Society's Board Responsibility for the Financial Statements

The Board of Society is responsible for the preparation of these financial statements that give a true and fair view of the financial position and incomes and expenditures of the Society in accordance with the accounting principles generally accepted in India, including the Accounting Standards, to the extent applicable, issued by the Institute of Chartered Accountants of India including the relevant provisions of the Act and Rules. This responsibility also includes maintenance of adequate accounting records for safeguarding the assets of the Society and for preventing and detecting frauds and other irregularities; selection and application of appropriate accounting policies; making judgments and estimates that are reasonable and prudent; and design, implementation and maintenance of adequate internal controls that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Board of Society is responsible for assessing the Society's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the Members either intend to liquidate the Society or to cease operations, or have no realistic alternative, but to do so.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

For **P. K. Gaur & Associates**

Chartered Accountants

Firm's Registration No. 0055183

M

Mayank



Mayank Gaur

Partner

Membership No.: 518183

UDIN: 23518183BGVSKN3638

Place: New Delhi

Date: 30th June, 2023



INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

BALANCE SHEET AS AT 31ST MARCH, 2023

(Amount in Rs.)

	Schedule	Current Year 2022-23	Previous Year 2021-22
<u>CORPUS/CAPITAL FUND AND LIABILITIES</u>			
CORPUS/ GENERAL FUND	1	1251,75,344	1179,82,891
RESERVE AND SURPLUS	2	-	-
EARMARKED/ ENDOWMENT FUNDS	3	30,19,447	26,12,330
SECURED LOANS AND BORROWINGS	4	-	-
UNSECURED LOANS AND BORROWINGS	5	-	-
DEFERRED CREDIT LIABILITIES	6	-	-
CURRENT LIABILITIES AND PROVISIONS	7	2816,44,209	2895,54,414
Total		4098,39,000	4101,49,635
<u>ASSETS</u>			
FIXED ASSETS	8	180,70,485	201,20,936
INVESTMENTS - FROM EARMARKED/ENDOWMENT FUNDS	9	2004,44,836	-
INVESTMENTS - OTHERS	10	1031,00,000	972,00,000
CURRENT ASSETS, LOANS, ADVANCES ETC.	11	882,23,679	2928,28,699
MISCELLANEOUS EXPENDITURE (to the extent not written off or adjusted)		-	-
Total		4098,39,000	4101,49,635
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTICES ON ACCOUNTS	25		

As per our report of even date

For P. K. Gaur & Associates
Chartered Accountants
Firm Reg. No. - 005311

Mayank Gaur
Partner
Membership No. 518183
Place: Delhi
Dated: 30/6/2023



Manager (F & A)

On behalf of the Council:

President : *Indrani* 30.6.23

Vice-President
(Finance & Establishment)

Deputy Executive Director



INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2023

(Amount in Rs.)			
	Schedule	Current Year 2022-23	Previous Year 2021-22
INCOME			
Income from Sales/Services	12	-	-
Grants / Subsidies	13	1359,63,381	1071,94,469
Fees/ Subscriptions	14	-	-
Income from Investments	15	25,61,637	24,45,100
Income from Royalty, Publication etc.	16	3,80,821	3,98,357
Interest Earned	17	132,67,333	35,60,976
Other Income	18	26,58,102	1,33,865
Withdrawal from Corpus Fund (reference Schedule-1)		-	-
Increase/(decrease) in stock of Finished goods and work-in-progress	19	-	-
Total (A)		1548,31,274	1137,32,767
EXPENDITURE			
Establishment Expenses	20	203,59,761	180,78,052
Other Administrative Expenses etc.	21	44,29,978	44,18,427
Expenditure on Grants, Subsidies etc.			
Utilization towards Engineering Programmes and Activities against DST Grants	22-A	277,73,363	165,01,851
Utilization towards SERB Grant for Abdul Kalam TIN Fellowship Scheme	22-B	729,76,127	649,25,167
Utilization towards SERB Grant for Digital Gaming Research Initiative	22-C	28,09,559	-
Utilization towards SERB-TNAE Collaborative Initiative in Engineering	22-D	69,84,841	-
Utilization towards AICTE Grant for Distinguished Visiting Professorship Scheme	22-E	4,51,093	27,05,653
Utilization towards AICTE-TNAE Travel Grant Scheme	22-F	2,00,631	1,85,777
Interest	23	94,88,197	1,77,300
Depreciation (Net Total at the year end - corresponding to Schedule 8)		20,49,835	23,07,400
Total (B)		1475,23,386	1092,99,627
Balance being excess of Income over expenditure (A-B)		73,07,888	44,33,140
Transfer to DKRC Development Fund		70,533	68,679
Transfer to Prof. Koddam Narsimha Memorial Lecture Endowment Fund		11,584	-
Transfer to Corpus Fund		24,79,520	23,76,421
Transfer to Fixed Assets (Grant utilised for Capital Assets)		4,78,319	4,39,407
BALANCE BEING SURPLUS / (DEFICIT) CARRIED TO GENERAL FUND		42,67,932	15,48,633
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

As per our report of even date

For P. K. Gaur & Associates
Chartered Accountants
Firm Reg. No. - 005311N

Mayank Gaur
Partner
Membership No. 518183
Place: Delhi
Dated: 30/6/2023



On behalf of the Council:

President :

Vice-President
(Finance & Establishment)

Manager (F & A)

Deputy Executive Director :



INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

(Amount in Rs.)								
SCHEDULE 1 - CORPUS/GENERAL FUND	General Fund 2022-23	INAE Corpus Fund 2022-23	INAE New Corpus Fund 2022-23	General Fund 2021-22	INAE Corpus Fund 2021-22	INAE New Corpus Fund 2021-22	Total Current Year 2022-23	Total Previous Year 2021-22
Balance as at Beginning of the year	673,48,901	506,33,990	-	658,00,268	477,57,569	-	1179,82,891	1135,57,837
Less : Unspent balance of PURA Project, in ITFAC	-	-	-	-	-	-	-	-
Add : Corpus received	-	-	-	-	-	-	-	-
Transferred (to)/from Income and Expenditure A/c	42,67,932	24,79,520	-	15,48,633	23,76,421	-	67,47,452	39,25,054
Contribution for INAE Corpus Funds	-	-	4,45,000	-	5,00,000	-	4,45,000	5,00,000
BALANCE AT THE YEAR END	716,16,834	531,13,510	4,45,000	673,48,901	506,33,990	-	1251,75,344	1179,82,891


 (Bhrovan Adhlakha)
 Manager (F&A)





INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

SCHEDULE 2 - RESERVES AND SURPLUS :		(Amount in Rs.)	
		Current Year 2022-23	Previous Year 2021-22
1. Capital Reserve			
As per last Account	-	-	-
Addition during the year	-	-	-
Less: Deductions during the year	-	-	-
2. Revaluation Reserve :			
As per last Account	-	-	-
Addition during the year	-	-	-
Less: Deductions during the year	-	-	-
3. Special Reserves			
As per last Account	-	-	-
Addition during the year	-	-	-
Less: Deductions during the year	-	-	-
4. General Reserve			
As per last Account	-	-	-
Addition during the year	-	-	-
Less: Deductions during the year	-	-	-
Total		Nil	Nil

(Bhuwan Adhikari)
Manager (F&A)





INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

		(Amount in Rs.)	
SCHEDULE 3- EARMARKED/ENDOWMENT FUNDS		Current Year 2022-23	Previous Year 2021-22
DKRC Development Fund (A)			
a. Opening balance		26,12,330	25,43,651
b. Additions to the funds			
i Transferred (to)/from Income and Expenditure A/c		70,533	68,679
c. Utilisation for the purpose		-	-
Sub-total A=(a+b-c)		26,82,863	26,12,330
Prof. Roddam Narsimha Memorial Lecture Endowment Fund (B)			
a. Opening balance		-	-
b. Additions to the funds			
i Contribution Received		3,50,000	-
ii Transferred (to)/from Income and Expenditure A/c		11,584	-
c. Utilisation/ Expenditure towards objectives of Funds			
i Expenditure for the purpose		25,000	-
Sub-total B=(a+b-c)		3,36,584	-
BALANCE AT THE YEAR END Total: (A+B)		30,19,447	26,12,330




 (Bhuwan Adhlakha)
 Manager (F&A)



INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

(Amount in Rs.)

SCHEDULE 4 - SECURED LOANS AND BORROWING:	Current Year 2022-23		Previous Year 2021-22	
1. Central Government		-		-
2. State Government (Specify)				
3. Financial Institutions		-		-
a) Term Loans	-		-	
b) Interest accrued and due	-	-	-	-
4. Banks :				
a) Term Loans	-		-	
- Interest accrued and due	-		-	
b) Other Loans (Specify	-		-	
- Interest accrued and due	-	-	-	-
5. Other Institutions and Agencies		-		-
6. Debentures and Bonds		-		-
7. Others (Specify		-		-
Total		Nil		Nil
Note : Amounts due within one year				

(Bhuvan Adilakhs)
Manager (F&A)





INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

(Amount in Rs.)		
SCHEDULE 5 - UNSECURED LOANS AND BORROWING:		
	Current Year 2022-23	Previous Year 2021-22
1. Central Government	-	-
2. State Government (Specify)	-	-
3. Financial Institutions	-	-
a) Term Loans	-	-
b) Interest accrued and due	-	-
4. Banks :		
a) Term Loans	-	-
b) Other Loans (Specify)	-	-
5. Other Institutions and Agencies	-	-
6. Debentures and Bonds	-	-
7. Fixed Deposits	-	-
8. Others (Specify)	-	-
Total	Nil	Nil
Note : Amounts due within one year		

SCHEDULE 6 - DEFERRED CREDIT LIABILITIES:		
	Current Year 2022-23	Previous Year 2021-22
a) Acceptance secured by hypothecation of capital equipment and other assets	-	-
b) Others	-	-
Total	Nil	Nil
Note : Amounts due within one year		



(Bhuvan Adilakha)
Manager (F&A)



INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

(Amount in Rs.)

SCHEDULE 7 - CURRENT LIABILITIES AND PROVISIONS		Current Year 2022-23		Previous Year 2021-22	
A. CURRENT LIABILITIES					
1. Salary Payable		5,98,370		-	
2. TDS & GST Payable		82,388		79,241	
3. Expenses/Bills Payable		5,38,225	12,18,983	7,99,116	8,78,357
4. Audit Fee Payable			70,800		70,800
	(including interest earned)				
5. Unspent DST Grant	21112	1,49,211		121,46,928	
6. Unspent AICTE Grant for DVP Scheme	0	-		31,63,472	
7. Unspent AICTE Grant for Teachers Research Fellowship Scheme		-		1	
7. Unspent AICTE Grant for Travel Grant Scheme	18760	7,13,566		8,95,437	
8. Unspent SERB Grant for Digital Gaming Initiative	8677671	2558,68,112		2500,00,000	
9. Unspent SERB Grant for Collaborative Activities	90271	6,05,430		75,00,000	
10. Unspent SERB Grant for Abdul Kalam TIN Fellowship	680383	92,33,640	2665,69,959	4,39,947	2741,45,785
B. PROVISIONS					
1. Provision for Gratuity			73,84,894		76,34,412
2. Provision for Leave Encashment			63,99,573		68,25,060
Total			2816,44,209		2895,54,414



(Signature)
(Bhuwan Aditakha)
Manager (F&A)



INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULE FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

SCHEDULE 8 - FIXED ASSETS

(Amount in Rs.)											
Description	Original cost of Asset as on 01.04.22	Asset Purchased during the year	Value of assets Disposed off/ sold	Original cost of Asset as on 31.03.23	Total Dep. Up to 01.04.22	Dep. for the Year	Depreciation on Assets Disposed off/ sold	Utilisation of Grant U/s 11(1)	Total Depreciation Up to 31.03.23	Net Block of Asset as on 31.03.23	Value of Asset as on 31.03.22
	1	2	3	4	5	6	7	8	9	10	11
A. FIXED ASSETS											
Part - I Equipments	5071409	478319	0	5549728	4342160	110666	0	478319	4931145	618583	729249
Part - II Furniture	13348632	0	9133	13339499	10071896	327675	8517	0	10391044	2948455	3276746
Part - III Building	53741479	0	0	53741479	37626538	1611494	0	0	39238032	14503447	16114941
Part-V Software -Digital Platform	5765600	0	0	5765600	5765600	0	0	0	5765600	0	0
	77927120	478319	9133	78396306	57806184	2049835	8517	478319	60325821	18070485	20120936
Part-IV Equipments out of Project Grant	0	0	0	0	0	0	0	0	0	0	0
Total :	77927120	478319	9133	78396306	57806184	2049835	8517	478319	60325821	18070485	20120936
B. CAPITAL WORK-IN-PROGRESS											
Software -Digital Platform											
TOTAL	77927120	478319	9133	78396306	57806184	2049835	8517	478319	60325821	18070485	20120936

0


 (Bhawun Adhikari)
 Manager (F&A)





INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

(Amount in Rs.)		
SCHEDULE 9 - INVESTMENT FROM EARMARKED/ENDOWMENT FUNDS	Current Year 2022-23	Previous Year 2021-22
1 Prof. Roddam Narasimha M L Endowment Fund (Term Deposit with SBI)	325000	-
2 SERB-INAE Digital Gaming Initiative Funds (Term Deposit with SBI)	200119836	
Total	200444836	-

SCHEDULE 10 - INVESTMENTS - OTHERS	Current Year 2022-23	Previous Year 2021-22
1 Corpus Fund (Term Deposit with SBI)	506,00,000	472,00,000
2 Others (Term Deposit with SBI)	525,00,000	500,00,000
Total	1031,00,000	972,00,000


 (Bhuwan Adhlakha)
 Manager (F&A)





INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

(Amount in Rs.)

Schedule 11 - Current Assets, Loans, Advances Etc.	Current Year 2022-23		Previous Year 2021-22	
A. Current Assets:				
1. Cash balances in hand (Including Cheque/ Draft, Revenue Stamps and Imprest)		14,322		29,447
2. Bank Balance:				
a) With Scheduled Banks:				
• On Current Accounts	-	-	-	-
• On Saving Account	82,560,490	82,560,490	283,667,831	283,667,831
Total (A)		82,574,812		283,697,278
B. Loan, Advances And Other Assets (Unsecured Considered Good)				
1. Advances and other amounts recoverable in cash or in kind or for value to be received:				
a) Pre payments *	276,957		213,848	
b) Advance to Expert Groups*	2,229,993		2,834,332	
c) Advance for SERB-INAE Collaborative Initiatives**	522,000		-	
d) Others*	4,131,688	7,160,638	733,182	3,781,362
2. Income Accrued				
a) On Investment from Earmarked/Endowment Funds	60,080		-	
b) On investments - others	2,825,031	2,885,111	4,413,132	4,413,132
3. Claims Receivable				
a) TDS Receivable	778,956		898,427	
b) Interest receivable	1,946,300			
c) Security Deposit	38,500	2,763,756	38,500	936,927
Total (B)		12,809,505		9,131,421
* Advances out of DST Grant treated as utilisation during the FY 2022-23		6,638,638		-
** Advances out of SERB Grant for -Collaborative Initiative treated as utilisation during the FY 2022-23		522,000		-
Total (A+B)		88,223,679		292,828,699





INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

(Amount in Rs.)		
SCHEDULE 12 - INCOME FROM SALES/SERVICES	Current Year 2022-23	Previous Year 2021-22
<u>1) Income from Sales</u>		
a) Sale of Finished Goods	-	-
b) Sale of Raw Material	-	-
c) Sale of Scrap	-	-
<u>2) Income from Services</u>		
a) Labour and Processing Charges	-	-
b) Professional /Consultancy Services	-	-
c) Agency Commission and Brokerage	-	-
d) Maintenance Services (Equipment/Property)	-	-
e) Others (Specify)	-	-
Total	Nil	Nil

(Bhuwan Adhlakha)
Manager (F&A)





INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDED 31ST MARCH, 2023

(Amount in Rs.)		
SCHEDULE 13 - GRANTS/SUBSIDIES (Irrevocable Grants & Subsidies Received)	Current Year 2022-23	Previous Year 2021-22
1 Central Government - Department of Science and Technology	505,41,130	391,03,872
2 Government Agencies		
SERB Grant for Abdul Kalam Technology Innovation National Fellowship Scheme	729,76,127	649,25,167
SERB Grant for Digital Gaming Research Initiative	28,09,559	-
SERB Grant for Collaborative Initiative	69,84,841	-
AICTE Grant for Distinguished Visiting Professor Scheme	4,51,093	27,05,653
AICTE Grant for Travel Grant (TG) Scheme	2,00,631	1,85,777
3 International Organisations	-	74,000
4 Other		
- Contribution received from DAE-Engineers Conclave 2022	4,00,000	-
- Contribution received from SERB-INAE Annual Convention 2022	5,00,000	-
- Surplus of Engineers Conclave 2022 received from Organising Comm. ISRO-LPSC Trivendrum	11,00,000	-
- Contribution from Fellows	-	2,00,000
Total	1359,63,381	1071,94,469

SCHEDULE 14 - FEES/SUBSCRIPTIONS	Current Year 2022-23	Previous Year 2021-22
1 Seminar/Program Fees		
Registration fee	-	-
Total	-	-
Note - Accounting policies towards each item are to be disclosed		



(Bhuvan Adhlakha)
 Manager (F&A)



INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDED 31ST MARCH, 2023

(Amount in Rs.)				
SCHEDULE 15 - INCOME FROM INVESTMENTS (Income on Invest from Earmarked/Endowment Funds transferred to funds)	Investment from Earmarked Fund		Investment - Others	
	Current Year 2022-23	Previous Year 2021-22	Current Year 2022-23	Previous Year 2021-22
1 Others (Interest from Term Deposit)	82,117	68,679	24,79,520	23,76,421
Total	82,117	68,679	24,79,520	23,76,421
TRANSFERRED TO EARMARKED/ENDOWMENT FUNDS	82,117	68,679	24,79,520	23,76,421

SCHEDULE 16 - INCOME FROM ROYALTY, PUBLICATION ETC.	Current Year 2022-23	Previous Year 2021-22
1) Income from Royalty	3,80,821	3,98,357
Total	3,80,821	3,98,357

SCHEDULE 17 - INTEREST EARNED.	Current Year 2022-23	Previous Year 2021-22
1) On Term Deposits:		
a) With Scheduled Banks	65,24,706	24,36,309
2) On Savings Accounts:		
a) With Scheduled Banks	67,42,627	11,24,667
Total	132,67,333	35,60,976
Note - Tax deducted at source to be indicated	6,52,471	2,43,631

SCHEDULE 18 - OTHER INCOME.	Current Year 2022-23	Previous Year 2021-22
1) Profit on Sale/disposal of Assets: (Net)		
a) Owned Assets	(616)	(3,119)
2) Miscellaneous Income	59,407	1,36,984
3) Institutional Overhead collected on implementation of Schemes	20,71,511	-
4) Renting out of office space	5,27,800	-
Total	26,58,102	1,33,865



(Signature)
(Bhuvn Adhlakha)
Manager (F&A)

INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2023

(Amount in Rs.)		
SCHEDULE 19 - INCREASE/(DECREASE) IN STOCK OF FINISHED GOODS & WORK IN PROGRESS.	Current Year 2022-23	Previous Year 2021-22
a) Closing Stock		
- Finished Goods	-	-
- Work-in-progress	-	-
b) Less: Opening Stock		
- Finished Goods	-	-
- Work-in-progress	-	-
NET INCREASE/(DECREASE) [a-b]	Nil	Nil

(Signature)
(Bhuvan Adhlakha)
Manager (F&A)





INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDED 31ST MARCH, 2023

(Amount in Rs.)		
SCHEDULE 20 - ESTABLISHMENT EXPENSES.	Current Year 2022-23	Previous Year 2021-22
1 Salaries and Wages	155,31,963	152,79,889
2 Interim Relief paid - pending release of grant of 7th CPC	-	-
3 Contribution to NPS out of DST Grant (12.80%)	27,29,505	13,22,859
4 Contribution to Gratuity and Leave Encashment	2,77,164	26,06,208
5 Staff Welfare Expenses	42,500	29,750
6 Leave Travel Concession (LTC)	1,62,548	1,67,510
Sub-total	187,43,680	194,06,216
7 Add: Contribution to NPS out of Internal Resource (1.20%)	5,96,179	-
8 Add: Contribution to Gratuity and Leave Encashment out of Internal Resource	10,19,902	-
Less: Establishment Expenses/Interim relief debited to AICTE Schemes	-	3,28,164
Less: Establishment Expenses/Interim relief & salary debited to SERB -Abdul Kalam TI National Fellow	-	10,00,000
Total	203,59,761	180,78,052

SCHEDULE 21 - OTHER ADMINISTRATIVE EXPENSES ETC.	Current Year 2022-23	Previous Year 2021-22
1 Electricity and power	4,53,320	1,77,678
2 Water Charges	26,666	1,272
3 Insurance	31,484	31,285
4 Repairs and maintenance	14,38,375	21,47,502
5 Rent, Rates and Taxes	68,603	1,04,672
6 Postage, Telephone and communication Charges	6,58,155	8,12,381
7 Printing and Stationary	1,29,737	1,48,077
8 Travelling and Conveyance Expenses	16,809	54,086
9 Subscription Expenses	1,77,000	1,77,000
10 Auditors Remuneration	70,800	70,800
11 Professional Charges	11,81,601	5,71,042
12 General Expenses	1,37,237	1,62,694
13 Bank Charges	2,031	11,556
14 Books and Periodicals	2,910	695
15 Nikshya Mitra Contribution	1,733	-
16 Training of Staff	19,454	47,687
17 Advertisement and Publicity	14,063	-
Sub-total	44,29,978	45,18,427
Less: Expenditure Debited to SERB Abdul Kalam TIN Fellowship Scheme	-	1,00,000
Less: Expenditure Debited to AICTE Schemes	-	-
Total	44,29,978	44,18,427



(Bhuwan Adhikha)
 Manager (F&A)



INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI
SCHEDULES FORMING PART OF INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

(Amount in Rs.)				
Schedule 22-A -Engineering Programmes And Activities Out Of DST Grant	Current Year 2022-23		Previous Year 2021-22	
	Details	Total	Details	Total
Expenditure On				
INAIE Seminars/Conferences/Symposium/Workshops				
Conferences :-		2,435,302		546,240
INAIE Youth Conclave/National Science Day Release of Compendiums	70,818		473,080	
INAIE Foundation Day - Aazadi ka Amrit Mahotsav	1,391,121		73,160	
Engineers Conclave	973,363		-	
Symposium:-		1,455,925		477,610
Innovation in Manufacturing Practices (IMP)	212,355		214,275	
National Frontiers of Engineering	1,243,570		263,335	
Seminars :-		413,220		50,000
Online Exposition of Innovation by Startups @NIT, Calicut	413,220		-	
Seminar on Ethics in Higher Education - Bangalore Chapter	-		50,000	
Workshops/Events:-		823,622		370,743
Round Table on Role of Hydrogen in India's Energy Strategy by Pune Chapter	-		33,777	
Workshop on Smart Cities in Karnataka- Bangalore Chapter	-		30,450	
INAIE Workshop Disposal of Laboratory Waste Management, Pune Chapter	-		183,057	
INAIE-NAIEK Workshop on High Temp Materials, Kolkata	489,972		-	
Participation in International Tradefare @DST Pavillion, New Delhi	305,877		-	
INAIE- Local Chapter Mumbai	1,200		-	
INAIE- Local Chapter Bangalore	7,155		-	
INAIE- Local Chapter Delhi	6,244		3,835	
INAIE- Local Chapter Kanpur- 100 Second Vedio Competition	13,174		51,000	
Online Workshop- Tech Transformation of Indian Agriculture-Bangalore Chapter	-		68,624	
INAIE Schemes		5,089,730		1,940,679
Distinguished Technologists / Professors	3,600,000		600,000	
INAIE Chair Professorships	1,058,516		-	
Mentoring of Engineering Teachers	112,370		355,204	
Mentoring of Engineering Students	294,324		256,695	
INAIE Travel Grant Scheme	24,520		-	
Frugal Innovation Nurturing Programme- FINP	-		728,780	
Research Studies / Projects		2,823,299		2,725,051
Expert Group By Prof. DN Singh on Industrial By Product for Sustainable Infrastructure Development	1,703		595,200	
Expert Group By Prof. Jayanta Bhattacharya on IRRI of Automation on Mineral Sector	240,476		-	
Expert Group By Prof. Lalit Kumar	-		125,340	
INAIE Satish Dhawan Chair of Engineering Eminence	1,350,000		1,800,000	
Landmark Compendiums on Aazadi ka Amrit Mahotsav	1,231,120		204,511	
INAIE Awards		-		4,965,000
Life Time Contribution Award	-		1,000,000	
Young Engineer Award	-		1,500,000	
Young Entrepreneur Award	-		800,000	
Women Engineer Award	-		600,000	
Innovative Student Projects Awards	-		415,000	
Outstanding Teachers award	-		250,000	
Professor Jai Krishna Memorial Award	-		200,000	
Professor SN Mitra Memorial Award	-		200,000	
INAIE Forums		-		-
Academy Meetings		1,521,785		461,963
Annual Convention		2,454,263		1,462,739
International Affairs		1,103,904		971,318
INAIE Publications		718,979		72,870
Financial Assistance for Engineering activities		-		-
INAIE Digital Platform Maintenance		2,294,697		2,457,638
Advances towards Engineering Programmes and activities		6,638,638		-
Total		27,773,363		16,501,851





INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI
SCHEDULES FORMING PART OF INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2023

(Amount in Rs.)

SCHEDULE 22-B -Expenditure out of SERB Grant for Abdul Kalam TIN Fellowship Scheme	Current Year 2022-23		Previous Year 2021-22	
	Details	Total	Details	Total
SERB-INAIE Abdul Kalam Technology Innovation National Fellowship		729,76,127		649,25,167
Abdul kalam TIN Fellowship- Research Grant	71823078			
Abdul kalam TIN Fellowship- Advt	42668			
Abdul kalam TIN Fellowship- Manpower	616081			
Abdul kalam TIN Fellowship- Misc exp	100000			
Abdul kalam TIN Fellowship- Meetings	394300			
Total		729,76,127		649,25,167

SCHEDULE 22-C -Expenditure out of SERB Grant for Digital Gaming Research Initiative	Current Year 2022-23		Previous Year 2021-22	
	Details	Total	Details	Total
SERB-INAIE Digital Gaming Research Initiative		28,09,559		-
SERB-INAIE Digital Gaming Conclave	1762899			
SERB-INAIE Digital Gaming -Advertisement	46660			
SERB-INAIE Digital Gaming -Technical Service & Const.	1000000			
Total		28,09,559		-

SCHEDULE 22-D -Expenditure out of SERB Grant for Collaborative Initiatives in Engineering	Current Year 2022-23		Previous Year 2021-22	
	Details	Total	Details	Total
SERB-INAIE Collaborative Initiative in Engineering		18,97,293		-
i. SERB-INAIE Conclave -Atmanirbhar Technologies - Engineering Secured Future				
a. Youth Conclave on Technology Self Reliance during Sept 15-18, 2022 at IIT Jodhpur	1547293			
b. Engineering Secured Future Nov 05-06, 2022 at IIT Kanpur	350000			
ii. SERB INAE Women Engineers Program		5,98,048		-
a. Workshop on Writing R&D Proposals for Women Engineers During Nov 10-11, 2022 at IIT Tiru	490011			
b. Workshop on Writing R&D Proposals for Women Engineers during Feb 23-24,2023 at IIT Gandh	108037			
iii. SERB-INAIE Outreach Programs for NE, J&K and Ladakh		14,51,577		-
a. Innovation Contest and showcasing during Nov 3-5, 2022 NIT Arunachal Pradesh	392048			
b. Outreach Prog. Sept 26-30, 2022 NIT Mizoram	371674			
c. Skill Development Idea to Prototype during Nov. 26-30, 2022 at NIT Nagaland	301051			
d. Outreach Prog. Feb 1-2,2023 at NIT Manipur	386804			
iv. SERB-INAIE Innovation Hackathon		17,65,923		-
a. SERB-INAIE Hackathon during Sept 3-4, 2022 at Jadavpur University	400000			
b. Gaming JAM during Sept 15-18, 2022 at IIT Jodhpur	1365923			
v. Institutional Overheads		7,50,000		-
Advance for Workshop on Writing R&D Proposals for Women Engineers during Feb 23-24,2023 at IIT Gandhinagar		5,22,000		-
Total		69,84,841		-

SCHEDULE 22-E -Expenditure out of AICTE Grant for Distinguished Visiting Professorship Scheme	Current Year 2022-23		Previous Year 2021-22	
	Details	Total	Details	Total
AICTE-INAIE Distinguished Professorship Scheme		4,51,093		27,05,653
Payment of Honorarium to Distinguished Professors	3,34,374		24,81,574	
Secretarial Assistance for Overheads	1,16,719		2,24,079	
Total		4,51,093		27,05,653

SCHEDULE 22-F -Expenditure out of AICTE- INAE Travel Grant Scheme	Current Year 2022-23		Previous Year 2021-22	
	Details	Total	Details	Total
AICTE- INAE Travel Grant Scheme		2,00,631		1,85,777
Reimbursement to Students under Travel Grant Scheme	95,839		81,692	
Secretarial Assistance for Overheads	1,04,792		1,04,085	
Total		2,00,631		1,85,777

(Signature)
 (Bhuwan Adhikari)
 Manager (F&A)





INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDED 31ST MARCH, 2023

(Amount in Rs.)		
SCHEDULE 23 - INTEREST	Current Year 2022-23	Previous Year 2021-22
a) On Fixed Loans	-	-
b) On Other Loans (including Bank Charges)	-	-
c) Interest accrued on DST Grants- added in unspent DST Grant	21,112	29,085
d) Interest accrued on SERB Grant for Abdul Kalam TIN Fellowship-added in unspent SERB Grant	6,80,383	28,833
e) Interest accrued on AICTE Grant for DVP Scheme-added in unspent AICTE-DVP Grant	-	83,168
f) Interest accrued on AICTE Grant for TG Scheme-added in unspent AICTE-TG Grant	18,760	36,214
g) Interest accrued on SERB Grant for Digital Gaming Research Initiative	86,77,671	-
h) Interest accrued on SERB Grant for Collaborative Initiative	90,271	-
Total	94,88,197	1,77,300

(Bhuwan Adhlakha)
Manager (F&A)





INDIAN NATIONAL ACADEMY OF ENGINEERING

SCHEDULE- 24

ACCOUNTING POLICIES

1. **Basis of Accounting**

These accounts are prepared on the basis of historical cost convention and on the accrual method of accounting.

2. **Grant-in-aid**

Grant received from the Department of Science & Technology and others are accounted to the extent utilized and unspent grant has been shown under current liabilities. Grants relating to fixed assets have been shown under Income and Expenditure Account and its utilization has been transferred to fixed assets under section 11(1) of the Income Tax Act, 1961.

3. **Fixed Assets**

Fixed Assets are stated at cost of acquisition including inward freight, duties and taxes and direct expenses related to acquisition.

4. **Depreciation on Furniture and Office Equipments**

Fixed Assets are depreciated on written down value method of depreciation as per following rate prescribed in Income Tax Rules

Building	- 10%	Office Furniture	- 10%
Office Equipments	- 15%	Computers	- 40%

However, no depreciation has been provided on assets purchased from 01.04.2017 and applied u/s 11(1) of The Income Tax Act, 1961 and in fixed assets schedule it has been shown as utilization under section 11 (1) of Income Tax Act 1961.

5. **Interest on Investments**

Interest is earned on two types of Investments, one against Corpus and General Funds and the other against Earmarked Funds. The interest earned on all the mentioned funds is included in Income and Expenditure account and thereafter interest related to Corpus and Earmarked Funds is transferred to respective funds.

6. **Gratuity & Leave Encashment**

Provision for Gratuity is made as per the payment of Gratuity Act, 1972 and provision for accumulated leave and encashment is made on the basis of number of days of leave accumulated for employee. Actuarial valuation is not made to ascertain such liability.

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SCHEDULE -25

CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS

1. During the year the office of Principal Director of Audit (Environment & Scientific Division) conducted an inspection on compliance audit for the period from 2017-18 to 2021-2022. The report majorly indicates the following liabilities which may devolve on the Trust:
 - i. Rs. 8.87 crores lying under corpus fund & General fund with INAE in contravention to the directions for the creation of such funds by Government of India.
 - ii. Rs. 26.12 lakhs lying unspent with Digital Knowledge Resource Centre (DKRC) Fund, not created with due approval (as per the report).

The Academy has decided to examine the observations provided in the above mentioned report.
2. Balance Sheet and Income and Expenditure account have been prepared as per uniform format of accounts for Central Autonomous Bodies prescribed by the committee of expert constituted with the approval of Hon'able Finance Minister.
3. Interest Income of Rs. 21,112/- will be surrendered to DST for the year 2022-23, which has been credited to 'Unspent DST Grant' for further transfer of funds to Consolidated fund of India through 'Bharat Kosh'.
4. Figures in Income and Expenditure Account and Balance Sheet have been given as applicable to INAE as per uniform format. Utilization against the grants has been shown under schedule 22A to F, This includes expenditure incurred and advances given for activities/programs.
5. During the year ended March 31, 2023 a sum of Rs.nil/- has been received from DST as Grant-in-aid towards capital asset creation and an opening unspent balance of Rs. 5,10,860/- was brought forward. Accordingly, the total available balances including the grant received during the year is of Rs. 5,10,860/-. Out of the said balance, a sum of Rs.4,78,319/- has been utilized towards procurement of Fixed Assets and interest for 2021-22 amounting Rs.8,043/- deposited to Bharat Kosh. At the end of March 31, 2023, the unspent balance amount of Rs.24,498/- is being carried forwarded to financial year 2023-24 along with interest Rs.6,469/-.
6. The balance of security deposits and advances are subject to confirmation/reconciliation.
7. A) INAE Corpus Fund was created in the financial year 2015-16 as approved in governing council meeting held on December 09, 2015 by transfer of Rs. 3,62,00,000/- from the balance available in the general fund as on April 01, 2015 and surplus Rs. 45,00,000/- of financial 2015-16. Interest on corpus fund investment has also been credited to such fund.

During the Governing Council meeting held on June 13, 2019 it was informed that the implementation of the Recommendations of the 7th Central Pay Commission for INAE employees applicable from January 01, 2016 is pending due to the fact that the relevant letter from DST has not yet been received till date. The matter is being pursued earnestly by INAE with DST.

Under the circumstances, the Governing Council considered to pay the interim relief and accordingly, an amount of Rs.1,16,03,895/- has been withdrawn towards payment of Interim Relief as arrears (contingent upon implementation of the Recommendations of 7th Central Pay Commission) from Jan 1, 2016 to May 31, 2019 amounting Rs.90,97,616/- and interim relief as additional monthly recurring expenditure amounting Rs. 25,06,279/- (against the total additional monthly recurring expenditure of Rs. 42,00,170/- after charging off Rs.10,00,000/- as manpower grant from SERB under Abdul Kalam TIN Fellowship and Rs.6,93,891/- as Secretarial Assistance grant from AICTE.)

Since INAE had applied to Department of Science and Technology (DST) for sanction of Grant and pending release of this grant, the sum of Rs. 1,16,03,895/- had been drawn from INAE Corpus Fund and the same will be recouped on receipt of the above grant from DST.

(Signature)





- B) Subsequently, DST raised an observation for giving interim relief akin to 7th CPC benefits to INAE staff, the interim relief being granted to INAE Staff was stopped w.e.f. July 01, 2020 and pay is being released as per 6th CPC scales. This was ratified by INAE Governing Council in 136th Meeting held on August 24, 2020 vide item no.12 of minutes. Interim relief for July 01, 2020 onwards, if any, will be accounted for after release of Grant from DST.
8. Investment from earmarked/endowment funds includes Rs. 3,25,000/- towards prof Roddam Narsimha ML lecture endowment fund created out of contribution received from INAE Bengaluru Chapter and Rs. 20,01,19,836/- out of grant received from SERB for digital gaming research initiative in form of Term deposit with SBI. Investment (others)- Term Deposit aggregating to Rs.10,31,00,000/- with SBI taken out of corpus fund and others have been included in investment (others).
9. Utilization certificates are being received from Research Scholars on term year end basis in place of financial year end basis, in respect of the expenditure of Rs. 7,18,23,078 on SERB- INAE Abdul Kalam Technology Innovation National Fellowship.
10. During the previous financial year the following Grant-in-aid had been received from Science and Engineering Research Board (SERB) and carry forward of these grants for expenditure during FY 2022-23 was granted towards new collaborative initiatives, unspent balances of which along with interest have been shown under Schedule-7:
- a. Grant-in-aid towards SERB- INAE Digital Gaming Initiative – Rs. 25.59 Crore
 - b. Grant-in-aid towards SERB- INAE Collaborative Activities – Rs. 6.05 Lakhs
11. During the year the approval for creation of a new Corpus Fund from INAE's own resources (internal accruals) has been received from Department of Science and Technology (DST), vide letter dt March 24, 2023. Accordingly, a new bank account no.41790835603 in the name of INAE Corpus Fund has been opened on March 29, 2023 with approval of 146th INAE Governing Council on Mar 27, 2023.
During the year a sum of Rs. 4,45,000/- has been received from INAE fellows as voluntary contributions with specific direction as corpus fund contribution.
12. Figures are rounded off to Rupees.
13. Previous years figures have been re-grouped/aligned, where ever found necessary.

For **P. K. Gaur & Associates**
Chartered Accountants
FRN 005311N

Mayank Gaur

Mayank Gaur
Partner
Membership No. 518183



Place: *Delhi*
Date: *30/6/23*

On behalf of the Council:

President *Indranil* *30.6.23*

Vice-President *W.S.*
(Finance & Establishment)

Deputy Executive Director *Alino*

Manager (F & A) *Shakti*





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