



Annual Report 2020-21



Indian National Academy
of Engineering

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Foreword

I take this opportunity to convey my best wishes to the Fellows, Foreign Fellows and Young Associates for good health and safety in the continued Covid-19 pandemic which has caused enormous losses and disruption of normal life. It is with great humility and pride that I took over the Presidentship of INAE on January 1, 2021 from my esteemed colleague Dr Sanak Mishra who made exemplary contributions during his tenure as the President, INAE. He has left behind a legacy of excellence in taking the Academy to greater heights which I shall make every effort to maintain and extend. I shall also seek guidance and advice from all the Former Presidents especially Dr BN Suresh, Dr PS Goel, Dr K Kasturirangan, Dr Anil Kakodkar and Prof P Rama Rao in conducting the affairs of INAE.

The last year has witnessed many challenges due to the pandemic leading to the cancellation of some of the flagship events such as Engineers Conclave, Youth Conclave and National Frontiers of Engineering Symposium. However, it is a matter of pride that the INAE Office functioned normally and all meetings and selection of Fellows and Awardees went as per schedule. The INAE Annual Convention organized online was a grand success and set an example for the future events being planned online in the same manner. As part of the online INAE Annual Convention 2020, INAE conducted a special Webinar Series from January 4, 2021 to January 20, 2021 featuring technical lectures by awardees for the year 2020 of Life Time Contribution Award in Engineering, Prof Jai Krishna and Prof SN Mitra Memorial Awards, INAE Outstanding Teachers Award, INAE Woman Engineer of the Year Award, Young Entrepreneur Award, Innovative Student Projects Award at Doctoral Level, Young Engineer Award and Newly elected Fellows/ Foreign Fellows affiliated to ten Engineering Sections of INAE. This is the first time that such an extensive programme was conducted online for the benefit of the Fellows, Young Associates and the engineering community at large. The contributions of the Annual Convention Organizing Committee led by Dr Pradip in the successful conduct of the online Annual Convention 2020 are highly appreciated and placed on record.

Some of the other major highlights of the last year are worth recapitulating. It is indeed heartening to note that in spite of difficult circumstances, a number of landmark achievements were made by INAE. INAE is recognized as an advisory body for various government and professional bodies because of which, INAE offers actionable recommendations on engineering interventions as outcome of various activities, studies and events to these agencies for implementation. In this regard, two new joint Consultative Committees have recently been constituted and operationalized with DRDO and CSIR. The joint DRDO-INAE Consultative Committee is constituted to meet at mutually agreed frequency to discuss and decide on areas of mutual interest for DRDO and INAE and align some of the activities of INAE with the thrust areas of national importance. Similarly, the CSIR-INAE Consultative Committee is constituted to identify topics for aligning some specific activities and programmes of INAE and CSIR so as to make



useful and synergistic contributions toward major engineering challenges faced by the nation. Meetings of these committees have since been held and notable progress made.

INAE undertakes specific tasks with the aim of generating policy recommendations. With a view to enhance the technological preparedness of the nation to face national disruptions of different types, INAE undertook a unique initiative. Dr BN Suresh, former President, INAE prepared a White Paper on “Technological Preparedness for dealing with National Disruptions to study all possible disruptions by a number of committees with domain specialists with the primary aim to examine technology preparedness of the country to face such exigency. This exercise requires defining the source and nature of such challenges, identifying the gaps and recommending the changes through scientific research and assessment for prescribing suitable technological solutions. The White Paper was discussed in a meeting with NITI Aayog and a Peer Committee was constituted under the chairmanship of Dr PS Goel, former President, INAE along with six Expert Committees to discuss aspects related to technological preparedness for dealing with national disruptions. The report by the Committee is being prepared shortly. Once completed, the report by this committee will mark a major contribution by the Academy in terms of increasing its visibility by effective contributions to the nation’s security as far as national disruptions are concerned.

Digitization of activities is high on the agenda of the Academy and a Digital Platform was created to facilitate INAE Fellows submitting nominations online for Fellowship, schemes and awards and also, for improved functioning and digitizing operations of INAE Office. This transformation was a huge success for creating facility for online submission of nominations for fellowship and awards. At this juncture, I express my sincere thanks to the Members of the INAE Digital Platform Committee led by Mr K Ananth Krishnan. I also thank all Sectional Committee and Awards Committees members for sparing their valuable time and ensuring that the meetings were held timely and successfully by their sincere contributions.

You may recall that INAE being a Member-Academy of the International Council of Academies of Engineering and Technological Sciences (CAETS) participates in its programmes/convocations of global concern at national and international levels. In the year 2020, the National Academy of Engineering of Korea (NAEK) hosted the CAETS Annual Meetings and Symposium on “Engineering a Better World- Smart Society” held online from October 12-15, 2020. Dr Sanak Mishra, the then President INAE was a nominated Member of the CAETS Strategy Development Working Group and Member, CAETS Board of Directors and he along with INAE Delegation participated in this prestigious online event. A nominated member from INAE participated in the CAETS COVID-19 Special Committee Meeting and the contributions of INAE were appreciated. During the Council Meeting of CAETS, INAE was commended for having brought out a volume of literature on COVID-19 in the form of a special issue of the Transactions of INAE. It was appreciated that INAE is the only Academy which has done so. INAE was also mentioned in respect of its contributions to the draft report of the Energy Committee and its active participation in the committees on Diversity and Sustainability.

A special issue of the Transactions of Indian National Academy of Engineering journal viz June 2020 issue on “Technologies for Fighting COVID-19” was published with the objective of providing a platform for collating appropriate technologies for mitigating various aspects of the COVID-19 Pandemic. The e-version of the issue was provided on open domain on Springer website for the benefit of researchers and readers from across the world. This was part of the initiative of INAE towards contributing to containment of the Covid-19 pandemic.

An important highlight of the last year is the launch of the INAE Webinar Series on topics of current engineering and technological interest. A number of interesting webinars were held with large audience and this activity is ongoing. The Local Chapters have also been active in conduct of webinars which is to be appreciated.

The Abdul Kalam Technology Innovation National Fellowship launched by INAE jointly with SERB, DST is progressing each year with the receipt of high-quality nominations. Until now, a total of twenty-seven awardees have been selected for conferment of the subject Fellowship since its inception. Six eminent nominees were conferred the subject Fellowship during this year. In addition, six nominees selected in previous years were granted extension based on the commendable work done under the aegis of the Fellowship. The Fellowship has gained huge interest and prominence in the engineering community in the country.

The Frugal Innovation Nurturing Programme set up by the Academy to promote grassroots innovations has progressed and it proposed to complete 25-30 projects as part of this programme and submit a study report to various agencies for scaling up all grassroots innovations in the country.

I would like to inform that subsequent to the launch of ***Azadi ka Amrit Mohotsav*** by the Government on 12th March 2021, a meeting of Prof Ashutosh Sharma, Secretary, DST with all Autonomous Professional Bodies under DST was held on 12th March 2021 regarding celebration of India's 75th Year of Independence which will fall on 15th August 2022, exactly after 75 weeks from that date. In this regard, a Task Force has been constituted to design and monitor the specific programs that INAE would pursue in the next 75 weeks in different locations and occasions. It is the endeavour to involve maximum number of Fellows and Young Associates in the activities.

The Academy thrives due to the active and significant contributions by the Fellows and Young Associates. There are many milestones that have been achieved but we are on a path of progress to still climb greater heights of excellence and I seek the further contributions of the Fellows and Young Associates in the activities of INAE in the coming years.

At this juncture I once again convey my deepest appreciation and express my best wishes for good health and well being of all and sincerely hope that the day comes soon when we can meet in person to attend the flagship events and meetings of INAE.

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 2021



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*)

: Dr. Purnendu Ghosh, Executive Director, Birla Institute of Scientific Research, Jaipur.



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.



Chief Editor of Publications

: Prof. K Bhanu Sankara Rao, Pratt & Whitney Chair Professor, School of Engineering Sciences and Technology, University of Hyderabad; Formerly Associate Director, Materials Development and Characterization Group and Head, Mechanical Metallurgy Division, IGCAR, Kalpakkam; Formerly Professor and Dean School of Engineering Sciences and Technology, University of Hyderabad, and Formerly Ministry of Steel Chair Professor, MGIT Hyderabad.

Members



Engg Section-I : Ms Alpa Sheth, Managing Director, VMS Consultants Pvt Ltd, Mumbai.



Engg Section-II : Prof. Subhasis Chaudhuri, Director, Indian Institute of Technology Bombay, Mumbai.



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



Engg Section-IV : Mr. DP Misra, Director, Development Consultants Pvt Ltd & Adviser, Jindal Steel and Power Ltd., Mumbai.



Engg Section-V : Prof. G Bhuvaneswari, Formerly Professor, Department of Electrical Engineering, Indian Institute of Technology, Delhi, New Delhi.



Engg Section-VI : Prof. Anurag Kumar, Former Director, Indian Institute of Science, Bangalore.



Engg Section-VII : Prof. S Gopalakrishnan, Department of Aerospace Engineering, Indian Institute of Science, Bangalore.



Engg Section-VIII : Dr. U Kamachi Mudali, Vice-Chancellor, VIT Bhopal University, Bhopal.



Engg Section-IX : Mr. MV Kotwal, Former Member of the Board & President-Heavy Engineering, Heavy Engineering Division, Larsen & Toubro Ltd., Mumbai.



Engg Section-X : Dr. V Jayaraman, Prof. Satish Dhawan Professor and Sr. Advisor (Space Applications), ISRO Headquarters, Bangalore.

Representatives of various Organisations



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

: Dr. BK Mishra, Director, Indian Institute of Technology, Goa.



Ministry of
Human Resource
Development
(MHRD)

: Prof. BS Murty, Director, Indian Institute of Technology Hyderabad & Institute Professor and Girija & R. Muralidharan Chair Professor IIT Madras.



Department of
Space (DOS)

: Dr. V Narayanan, Director, Liquid Propulsion Systems Centre, Indian Space Research Organisation, Department of Space, Govt. of India, Thiruvananthapuram.



All India Council
for Technical
Education (AICTE)

: Prof. Manoj K Tiwari, Director, National Institute of Industrial Engineering (NITIE), Mumbai.



Indian National
Science Academy
(INSA)

: Prof. V Ramgopal Rao, Director, Indian Institute of Technology Delhi, New Delhi.



Defence Research
& Development
Organisation
(DRDO)

: Dr. SV Kamat, Director General, Naval Systems and Materials, DRDO, DG (NS&M) Office, Visakhapatnam.



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)

: Mr. Soumitra Biswas, Adviser-Technology & Innovation, Confederation of Indian Industry (CII), 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 Gaurav Hazra, VP and member of the NASSCOM leadership team.

INAE Committees

Sectional Committees

The composition of the ten Sectional Committees is given below.

Sectional Committee-I

(Civil Engineering)

Convener

Mr. VN Heggade

Members

Prof. S Arunachalam

Prof Subrata Chakraborty

Prof. MC Deo

Prof. Subhasish Dey

Prof. R Gettu

Dr. SK Kamra

Mr. MM Madan

Prof. PP Mujumdar

Prof. Ligy Philip

Dr. VN Sharda

Prof. Mahesh C Tandon

Sectional Committee-II

(Computer Engineering and Information Technology)

Convener

Dr. Manish Gupta

Members

Prof. Pallab Dasgupta

Prof. PJ Narayanan

Dr. Raghu Krishnapuram

Mr. Vinay V Kulkarni

Prof. Ujjwal Maulik

Prof. Sushmita Mitra

Prof Jayanta Mukhopadhyay

Prof Hema A Murthy

Prof. Sukumar Nandi

Dr. Rajeev Rastogi

Prof. S Sudarshan

Sectional Committee-III

(Mechanical Engineering)

Convener

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Members

Prof. Amit Agrawal

Prof. Suman Chakraborty

Prof. Anindya Deb

Prof. A Ghosal

Mr. K Jayarajan

Dr. Dasharath Ram

Dr. CP Ramanarayanan

Dr. N Ravichandran

Mr. Anil Kumar Sinha

Mr. Atul Sobti

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(Chemical Engineering)

Convener

Prof AK Suresh

Members

Prof. KG Ayappa

Prof. JR Bellare

Prof. Sunando Dasgupta

Dr. MO Garg

Prof. Animangsu Ghatak

Prof. Yogesh M. Joshi

Mr. VK Khilnane

Dr. V Choudary Nettem

Prof. AW Patwardhan

Dr. CV Rode

Mr. Sudhir Vasudeva



Sectional Committee-V

(Electrical Engineering)

Convener

Prof. Ashok Kumar Pradhan

Members

Prof. Vivek Agarwal

Mr. Mukesh Bhandari

Prof. G Bhuvaneswari

Prof. Amitava Chatterjee

Prof. SV Kulkarni

Dr. BK Panigrahi

Prof. NP Padhy

Dr. Vijay Kanchanlal Shah

Dr. Archana Sharma

Prof. SA Soman

Mr. K Sreekumar

Sectional Committee-VI

(Electronics & Communication Engineering)

Convener

Prof. Swades Kumar De

Members

Prof. Manav Bhatnagar

Prof. Nandita Dasgupta

Prof. Debatosh Guha

Prof. RD Koilpillai

Mr Sanjay Nayak

Dr. MM Mehendale

Dr. R Muralidharan

Dr. N Ramamurthy

Dr. SD Sherlekar

Mr. S Varadarajan

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Sectional Committee – VII

(Aerospace Engineering)

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Mr. T. Suvarna Raju

Members

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Prof. MS Bhat

Mr. MV Dhekane

Prof. S Gopalakrishnan

Prof. G Jagadeesh

Dr. V Narayanan

Dr. Jagannath Nayak

Mr. S Pandian

Mr. S Somanath

Prof. K Sudhakar

Dr. K Tamilmani

Sectional Committee – VIII

(Mining, Metallurgical and Materials Engineering)

Convener

Dr DK Likhi

Members

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Dr. Biswajit Basu

Dr. SK Biswal

Dr. RN Ghosh

Dr. R Gopalan

Prof. Dipak Mazumdar

Mr. SS Mohanty

Prof. NK Mukhopadhyay

Prof. DC Panigrahi

Dr. SC Sharma

Dr. S Tarafder

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

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Other Committees and Forums

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Members from DST

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Dr. HK Mittal

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Members from INAE

Dr. Sanak Mishra

Dr. BN Suresh

Dr. Purnendu Ghosh

Prof. AB Pandit

Prof. Sivaji Chakravorti

Prof. V Ramgopal Rao

CSIR-INAE Consultative Committee

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Prof. Indranil Manna

Members from CSIR

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Dr L Venkatakrishnan

Dr Naresh Chandra Murmu

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Prof. Sivaji Chakravorti

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Dr. DR Prasada Raju

JS&FA, DST

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Dr. Sanak Mishra

Dr. BN Suresh

Dr. PS Goel

Dr. Pradip

Prof. AB Pandit

Prof. Sivaji Chakravorti

Mr. Shirish Panda

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DRDO-INAE Consultative Committee

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Members from DRDO

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Dr Mayank Dwivedi

Dr Shiv Kumar

Members from INAE

Dr. Sanak Mishra

Dr. BN Suresh

Dr. PS Goel

Dr. Purnendu Ghosh

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Prof. Ashok Kumar Pradhan

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Dr. Soumitro Tarafder

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Dr. S Jaikishan

Dr. V Jeyaraj

Dr. P Parameswaran

Dr. Vasant Shinde

Dr. Sharada Srinivasan

Prof. Vibha Tripathi

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Members

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Prof. Sivaji Chakravorti

Prof. Santanu Chaudhury

Prof. Sukumar Mishra

Prof. S Narayanan

Dr. BK Panigrahi

Dr. Pradip

Prof. Kripa Shanker

Dr. Rajiv Kumar Tayal

Prof. Manoj K Tiwari

Rep., AICTE

Rep – CII

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Prof. Suman Chakraborty

Prof. Sirshendu De

Prof. G Jagadeesh

Prof. NK Mukhopadhyay

Prof. Sushmita Mitra

Prof. CVR Murty

Prof. Hema A Murthy

Prof. Ligy Philip

Prof. Krishna Moorthy Sivalingam

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Dr. Purnendu Ghosh

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Members

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Prof. G Jagadeesh

Prof. Sushmita Mitra

Prof. NK Mukhopadhyay

Prof. CVR Murty

Prof. Hema A Murthy

Prof. Ligy Philip

Prof. Satyam Suwas

Prof. SV Kulkarni

Prof. Nandita Dasgupta

Rep - AICTE

Rep – CII

Forum on Indian Landscape of Advanced Structural Materials

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Mr. Pradeep Chaturvedi

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Mr. N Saibaba

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Mr. AK Tripathy

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Mr. AK Anand

Dr. YP Anand

Mr. Pradeep Chaturvedi

Mr. Keshav Chandra

Mr. AK Gupta

Mr. SC Gupta

Mr. MV Kotwal

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Mr. AP Mishra

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Prof. Prem Krishna

Ms. Alpa Sheth

Prof. DN Singh

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Prof. Santosh Kapuria

Mr. Sanjay Pant

Prof. N Raghavan

Mr. K Senou

Dr. Mangu Singh

Prof. PK Sikdar

Prof. Mahesh C Tandon

Digitization of INAE activities

The INAE Digital Centre was formally inaugurated by Prof Ashutosh Sharma, FNAE, Secretary, DST on February 15, 2019, which is located at the 9th Floor in the same building viz. SPAZE IT Park, Tower A, Gurgaon wherein the current INAE Office is housed at the 6th Floor. The INAE Digital Platform Committee constituted under the Chairmanship of Dr. Pradip, Vice-President, INAE with Mr. K Ananth Krishnan, Dr. Manish Gupta, Mr. Vinay V Kulkarni, Prof. Hema A Murthy, Dr. Sriram K Rajamani and Dr. K Ramamritham as members had played an important role in revamping and developing of newly designed interactive INAE website which is functional featuring Wider Slide Show of photos; Improved Site search; Quick Links; What's New - section including Recent / Forthcoming activities and INAE Activities Spotlight; Improved Sitemap (for better website navigation); Online application for INAE schemes; Downloadable INAE publications and Social media Integration. A Review Committee of INAE Digital Platform was formed under the Chairmanship of Mr. K Ananth Krishnan to review progress of digitization and plan way forward. Under the guidance of the said Committee, online modules facilitating online submission of nomination for INAE Schemes, INAE Awards, AICTE-INAE Schemes and SERB Scheme have been created. Twenty-two modules were identified for digitization based on the existing schemes and awards dealt by the Academy.

There have been many changes in the Digital Platform since its inception and the platform being a dynamic one, more changes in modules are expected with introduction of new concepts. The Chairman proposed to have new Digital Platform Committee with members who can guide way forward. The Digital Platform Committee was reconstituted under Chairmanship of Mr. K Ananth Krishnan with Dr. Manish Gupta, Mr. Vinay V Kulkarni, Prof. Hema A Murthy, Dr. Sriram K Rajamani and Prof Sukumar Nandi as members and Dr. Pradip and Dr. Purnendu Ghosh as permanent invitees in September 2020. The first meeting of the Committee was held on October 5, 2020.

The Digital Platform provides the following:

» **Facilities for INAE Fellows and Young Associates**

- Secure Login for INAE Fellows, Staff and Young Associates
- INAE Fellow personal Profile page with Dashboard
- Access to Transactions of INAE
- Request for Webinar
- Online Travel Request for INAE Fellows

» **Online facilities provided in INAE Website (open domain) for application**

- INAE Young Engineer Award
- INAE Travel Grant
- Innovative Student Projects Award
- AICTE-INAE Travel Grant Scheme
- AICTE-INAE Distinguished Visiting Professorship Scheme
- Abdul Kalam Technology Innovation National Fellowship (yet to be activated)



» Online facilities for Nominations by INAE Fellows

- Nomination for INAE Fellowship (includes both Indian and Foreign Fellowship)
- Mentoring of Engineering Teachers by INAE Fellows
- Mentoring of Engineering Students by INAE Fellows
- Lifetime Contribution Award in Engineering
- Professor SN Mitra Memorial Award
- Professor Jai Krishna Memorial Award
- INAE Outstanding Teachers Award
- INAE Young Engineer Award
- INAE Women Engineer of the Year Award
- INAE Young Innovator and Entrepreneur Award (yet to be activated)
- INAE Chair Professorship (Scheme temporarily on hold)
- INAE Distinguished Professor/Technologist (Scheme temporarily on hold)

Online nominations: Eight modules have been made live in 2020 to receive online nominations and application as per details given below:

1. Nomination for INAE Fellowship
2. Lifetime Contribution Award in Engineering
3. Professor Jai Krishna Memorial Award
4. Professor SN Mitra Memorial Award
5. INAE Outstanding Teachers Award
6. Mentoring of Engineering Teachers by INAE Fellows
7. Mentoring of Engineering Students by INAE Fellows
8. AICTE-INAE Travel Grant Scheme

Nominations and applications have been received through Digital Platform for the above modules and were processed successfully at the back end. In Fellowship Nomination module, carried forward nominations from previous years (2018 & 2019) and new nominations which have been received through email this year were collated and uploaded on the Digital Platform to facilitate INAE Fellowship to review nominations online. Enabling this facility helped receive more than 300 reviews on 280 nominations.

The Sectional Committee review were successfully organized online wherein each Sectional Committee members had reviewed the nominations online before respective meetings and put forward their comments on nominees to Convener using the Digital Platform.

Digital Platform was also used this year to review nominations of INAE prestigious awards namely Lifetime Contribution Award in Engineering, Professor Jai Krishna Memorial Award, Professor SN Mitra Memorial Award and INAE Outstanding Teachers Award.

INAE Webinar Series

Launch of INAE Webinar Series

INAE launched a Webinar Series on topics encompassing all sectors and disciplines of engineering and technology. It has been a long-cherished plan of the Academy to launch the Webinar Series in the year 2020. The INAE Webinar Series is an important new initiative of the INAE Digital Platform. INAE is geared to host events on this platform for the benefit of the Fellowship. It is planned to hold at least one Webinar every month, and if felt necessary, one every fortnight. The first Webinar on May 23, 2020, featured two talks, one on “Launch of INAE Webinar Series” by Mr K Ananth Krishnan, FNAE, EVP and CTO, TCS and a technical talk on “Enterprise Digital Twin” by Mr Vinay Kulkarni, FNAE, Chief Scientist, TCS Research. A total of 58 INAE Fellows/ Foreign Fellows/Young Associates/other invitees participated in the first Webinar held on May 23, 2020, out of 103 registered participants and received good feedback. The recording of the Webinar has been uploaded in INAE You tube account, and an access has been provided on INAE website.

A second Webinar was held on 13th June 2020 on the topic “Does Hydrogen have a role in India’s Energy Strategy?” and the four speakers were Dr. SSV Ramkumar, Director R&D, IOCL; Dr. Ashish Lele, Senior VP and Head, Advanced Materials and Alternate Energy, Reliance Industries Limited; Dr. RR Sonde, EVP, Research, Technology and Innovation, Thermax and Dr. P C Maithani, Advisor, MNRE, Govt. of India. Mr MV Kotwal, Independent Director on Boards - Sanghvi Movers Ltd. & Kirloskar Ferrous Industries Ltd and Ex-Member of the L&T Board & President Heavy Engineering was the Moderator of the second webinar. The Q & A Session was held after the four speakers made their presentations which was coordinated by Mr Sachin Chugh, Chief Research Manager, Indianoil R&D Centre. A total of 151 INAE Fellows/ Foreign Fellows/Young Associates/other invitees participated in the second Webinar. The recording of the second webinar has also been made available in INAE YouTube Channel and link provided on INAE Website.

The third Webinar was held on July 25, 2020 on “Strategy for Accelerated Growth of Renewable Energy Application in India”. The webinar started with opening statement by Dr. Sanak Mishra, President, INAE and was moderated by Mr. Pradeep Chaturvedi. Dr Ajay Mathur, Director General, TERI; Mr Sumant Sinha CMD, Renew Power; Mr K.S. Popli, Former CMD, IREDA; Dr P.C. Maithani, Adviser, MNRE - Dealing with Policy Matters and Mr Upendra Tripathi, DG, International Solar Alliance were the invited speakers for the webinar.

Since May 2020 fourteen webinars have been organized by several INAE Local Chapters as a part of INAE Webinar Series using INAE Digital facility.

With increasing activity, a formal committee was proposed to help create digital content, leverage webinar and plan more activities to reach out to larger community of engineers. INAE Digital Content and Webinars Committee was formed under Chairmanship of Mr. K Ananth Krishnan with members of the Committee are Prof. K Bhanu Sankara Rao, Prof. UB Desai, Dr. SV Kamat, Dr. Arunn Narasimhan, Mr. T. Suvarna Raju, Prof. AK Suresh, Dr. Debashish Bhattacharjee, Dr. Manish Gupta, Dr. DK Likhi, Mr. Anil V Parab, Dr.(Smt.) Saswati B. Roy, Prof. Manoj Kumar Tiwari, Prof. Swades Kumar De, Mr. VN Heggade, Prof. Hema A Murthy, Prof. Ashok Kumar Pradhan, Ms Alpa Sheth.



The links of the recordings of the webinars are available in INAE website. Details of the webinars conducted are as enlisted below:

Date of Webinar	Webinar Theme	Speaker
Webinar 1 May 23, 2020	Launch of INAE Webinar Series by Mr K Ananth Krishnan, FNAE, EVP and CTO, TCS	Launch of Webinar Series by: Mr. K Ananth Krishnan, FNAE, EVP and CTO, TCS Speaker: Mr. Vinay Kulkarni, FNAE, Chief Scientist, TCS Research
Webinar 2 Jun 13, 2020	Does Hydrogen have a role in India's Energy Strategy?	1. Dr SSV Ramakumar, Director R&D, IOCL 2. Dr Ashish Lele, Senior VP and Head, Advanced Materials and Alternate Energy, Reliance Industries Limited 3. Dr RR Sonde, EVP, Research, Technology and Innovation, Thermax 4. Dr PC Maithani, Advisor, MNRE, Govt of India
Webinar 3 Jul 25, 2020	Strategy for Accelerated Growth of Renewable Energy Application in India	Welcome Address By: Dr Sanak Mishra, President INAE Speaker: 1. Dr Ajay Mathur, FNAE, Director General, TERI 2. Mr Sumant Sinha, CMD, ReNew Power 3. Mr K.S. Popli, FNAE, Former CMD, IREDA 4. Dr PC Maithani, Advisor, MNRE, Govt of India
Webinar 4 Sep 15, 2020	S&T Contributions of the Bangalore Region to the National Efforts Against COVID-19	Welcome & Introductory Remarks By: Dr VK Aatre, Chairman, INAE BC Speaker: 1. Prof. Raghavan Varadarajan, Molecular Biophysics Unit, IISc, Bangalore 2. Shri JJ Jadhav, Director, CSIR-NAL, Bangalore 3. Dr NS Kumar, Sc G, & Assoc Director, DRDO-DEBEL, Bangalore 4. Shri MV Gowtama, CMD, BEL, Bangalore 5. Prof Rahul Roy, Department of Chemical Engineering, IISc, Bangalore Vote of Thanks: Dr KJ Vinoy, Member EC, INAE BC & Dept of ECE, IISc Bangalore
Webinar 5 Sep 15, 2020	Hypothetico-Deductive "Construction" of New Knowledge in Industrial R&D and Academic Research	Prof. Vijay M. Naik, FNAE, Department of Chemical Engineering, IIT Bombay

Date of Webinar	Webinar Theme	Speaker
Webinar 6 Sep 15, 2020	Artificial Intelligence & Ethics	Prof. Anupam Basu, FNAE, Director, NIT Durgapur and Professor-on-lien, Department of Computer Science and Engineering, IIT Kharagpur
Webinar 7 Sep 24, 2020	Enriching Engineering Education Through Experimental, Collaborative and Social Learning	Prof PV Madhusudan Rao, Abdul Kalam Technology Innovation National Fellow of INAE and Mehra Chair Professor, IIT Delhi
Webinar 8 Oct 13, 2020	700 MWe Indian Pressurized Heavy Water Reactor	Shri A.K. Balasubrahmanian, Director (Technical), Nuclear Power Corporation of India Limited (NPCIL)
Webinar 9 Nov 10, 2020	Flight demonstration of Indigenous hypersonic air-breathing cruise vehicle	Prof Debasis Chakraborty, Aerospace Engineering Department, IIT, Bombay, Formerly, Associate Director (Technology), Group Director (Design), DRDL, Hyderabad
Webinar 10 Dec 17, 2020	High Intensity Superconducting Proton Accelerators (HISPA): Challenges & Achievements	Introductory Remarks By: Dr Ajit Kumar Mohanty, Director, BARC Speaker: Srinivas Krishnagopal, Head, Ion Accelerator Development Division, Bhabha Atomic Research Centre
Webinar 11 Jan 27, 2021	Engineering of Carbon Nanotubes and their Applications	Dr Kinshuk Dasgupta, Bhabha Atomic Research Centre, Recipient of Shanti Swarup Bhatnagar Award 2020
Webinar 12 Feb 16, 2021	Implications of NEP-2020 for Engineering Education in India	Prof. RK Shevgaonkar, FNAE, Professor Emeritus, IIT Bombay
Webinar 13 Feb 28, 2021	Individual Atoms as Clocks and Bits	Presided over by: Prof. Indranil Manna, President, INAE Speaker: Professor David J. Wineland, Nobel Laureate in Physics 2012 University of Oregon, USA
Webinar 14 Mar 31, 2021	Outlook for Nuclear Power in India – Utility Perspective	Introductory Remarks By: Mr S K Mehta, FNAE, President, Indian Nuclear Society Speaker: Mr S K Sharma, Chairman and Managing Director, Nuclear Power Corporation of India Limited

Presently, there are two applications namely Expert Pool and the Fellow Profile Page which were created at different times by two different vendors to maintain profiles of Fellows. While Expert Pool is a static database and resides in



public domain of INAE Website, the individual Profile Page of INAE Fellow is not in public domain of the website and can only be accessed by authenticated login. It has been observed that both the applications have similar fields but are supported by two separate databases. To do away with duplication of data, INAE Digital Platform Committee worked out a proposal wherein the data uploaded on Profile Page of the Fellows may be transferred to Expert Pool with the permission of individual Fellow. While completing the profile page, each Fellows will be given a choice as to whether his/her profile is to be made available in public domain (Expert Pool), so that other Fellows or people from Industry, Academia, R&D sector, private trusts, Government agencies, startups and entrepreneurs may access the same.

INAE on Facebook , Twitter , LinkedIn and You tube

INAE has created a Facebook and Twitter Account to post the news of recent INAE activities in the Social Media. The same can be viewed at the link below.

- (a) Facebook -link <https://www.facebook.com/pages/Indian-National-Academy-of-Engineering/714509531987607?ref=hl>
- (b) Twitter handle link <https://twitter.com/inaehq1>
- (c) LinkedIn- link <https://www.linkedin.com/in/inae-inae-20258b178/>
- (d) You Tube- link <https://www.youtube.com/channel/UCXOkjYeIRPADua-dny4W1Xg>

All INAE Fellows are requested to visit and follow the above to increase the visibility of INAE in Social media.

INAE Office Staff



LT COL SHOBHIT RAI (Retd.)
Deputy Executive Director



DR. GEETANJALI SAWHNEY
Senior Research Officer



MS. PRATIGYA LAUR
Research Officer



MR. VIRENDER KUMAR
Senior Manager (A&E)



DR. DEBJANI BHATTACHARYA
Research Officer



MS. SHELIKA ARORA
Research Officer



MR. BHUWAN ADHLAKHA
Manager (F&A)



MR. RAMACHANDRAN EP
Manager (A&E)



MR. SHEETAL SHARMA
Assistant Systems Engineer



MR. RAHUL GARG
Assistant Systems Engineer



MS. HEMA GUPTA
Senior Assistant Grade-I



MR. RS CHAUHAN
Senior Assistant Grade-III



MR. BALWANT SINGH
Assistant Grade-I



MR. GOURAV D KANDALGAONKAR
Assistant Grade-II



MS. RIDHI VASHISHT
Assistant Grade-II



MR. SATISH KUMAR VERMA
Multi-Tasking Staff

New Initiatives during the Year

During the last one year, INAE, in addition to many of its well-defined activities, has been giving a major thrust to identify the issues of National importance where engineering interventions can provide the appropriate solutions and also to get associated with some of the vital policy matters. INAE has been making efforts to identify such problems of National importance in consultation with many of the Government Departments and is looking at the policy matters which are referred to the Academy by the concerned agencies for generating the right inputs. With this objective in mind, INAE has undertaken a number of new initiatives in terms of commencing new programmes and conduct of unique events during this year, which have enhanced the outreach and visibility of the Academy both in India and abroad. INAE has also initiated novel programmes and instituted an award to honour distinguished women engineers. A brief summary of these novel initiatives is highlighted below.

INAE White Paper on Technological Preparedness for Dealing with National Disruptions

INAE prepared a White Paper on “Technological Preparedness for dealing with National Disruptions”. Dr. B.N. Suresh, Immediate Past -President, INAE had prepared the base paper in this regard, with inputs from Dr. P.S. Goel, former President, INAE, Dr. Bhujanga Rao, FNAE and other domain experts from INAE Fellowship. The White Paper on “Technological Preparedness for dealing with National Disruptions” integrating all the inputs was compiled by Dr BN Suresh and forwarded to Shri Amitabh Kant, CEO, NITI Aayog; Dr VK Saraswat, Member, NITI Aayog; Prof K Vijay Raghavan, PSA to Govt. of India and Prof Ashutosh Sharma, Secretary, DST, Govt. of India with a request for an opportunity of consulting with them over a WebEx meeting to take this initiative forward. Positive response had been received from DST to take this initiative ahead.

In response to this initiative, NITI Aayog convened a virtual meeting under the chairmanship of Dr. VK Saraswat, Member, NITI Aayog on 10th August 2020, to discuss the future course of action to implement the recommendations of the White Paper on ‘Technological Preparedness for dealing with National Disruptions’, with a view to take the initiative forward. The meeting was attended by Dr. Sanak Mishra, President, INAE, Dr. BN Suresh, Immediate Past-President, INAE, Dr. PS Goel, Former President, INAE, Dr. VK Saraswat, Member, NITI Aayog; Shri Neeraj Sinha, Adviser (S&T) and Dr. Ashok A. Sonkusare, Jt. Adviser (S&T), NITI Aayog and Lt Col Shobhit Rai (Retd), Deputy Executive Director, INAE. The meeting was successfully concluded to arrive at an action plan to implement the recommendations suggested in the subject White Paper. It was suggested that a Peer Committee be constituted with member experts from INAE and NITI Aayog who would further identify Sub-committees to take up specific task envisaged to take this initiative to its logical conclusion.

On behest of NITI Aayog, a Peer Committee for “Technological Preparedness for dealing with National Disruptions” had been constituted under the chairmanship of Dr PS Goel, Past-President, INAE with representation of senior officials from IMD, NDMA, NITI Aayog, DST, CSIR, ICMR, DAE, ISRO, DRDO, DBT and Indian Coast Guard (ICG). This Committee has further identified specific domains and constituted following six sub-Committees with the purpose to bring out a roadmap for recommending a mechanism to maintain an up-to-date dashboard in the public domain and easy-to-access data base on history, experts, facilities, and archive related to all kinds of disasters.

- (a) Atmosphere and Climate related disasters chaired by Dr Mrutyunjay Mohapatra, Director General of Meteorology, India Meteorological Department



- (b) Geology related disasters chaired by Dr VM Tiwari, Director, CSIR-National Geophysical Research Institute (NGRI)
- (c) Health related disasters chaired by Dr Chander Shekhar, Former Additional Director General, Indian Council of Medical Research (ICMR)
- (d) Ocean related disasters chaired by Dr M Ravichandran, Director, National Centre for Polar and Ocean Research (NCPOR)
- (e) Cyber Security related disasters chaired by Dr Gulshan Rai, Former National Cyber Security Coordinator, Government of India
- (f) Fire related disasters chaired by Shri Rajiv Narang, Director, The Centre for Fire, Explosive and Environment Safety (CFEES), DRDO

The report is under preparation and shall be published shortly.

Launch of INAE Webinar Series

INAE launched a Webinar Series on topics encompassing all sectors and disciplines of engineering and technology. It has been a long-cherished plan of the Academy to launch the Webinar Series in the year 2020. The INAE Webinar Series is an important new initiative of the INAE Digital Platform. Further details are given in the section on “Digitization of INAE Activities”.

Two New Joint Consultative Committees

This year, two new joint Consultative Committees have been constituted as given below.

DRDO-INAE Consultative Committee

A joint DRDO-INAE Consultative Committee was constituted to meet on mutually agreed frequency to discuss and decide on areas of mutual interest for DRDO and INAE to align the activities undertaken by INAE with the thrust areas of national importance.

CSIR-INAE Consultative Committee

The main objective of this newly constituted Committee is to identify topics for aligning of activities and programmes of INAE and CSIR with thrust areas of national engineering challenges and to undertake joint activities on topics of mutual interest.

Further details are given in the section on “Reaching out to Policy Makers: Interaction with Government Agencies”.

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. Due to unprecedented circumstances on account of COVID pandemic, the flagship/other national/international events planned during the year 2020, viz, Engineers Conclave; National Frontiers of Engineering; and Youth Conclave could not be undertaken.



Other Activities/Affairs of INAE

Frugal Innovation Nurturing Program (FINP)

Grassroots innovations are basically innovative solutions developed to overcome certain challenges arising during the course of the day- today's activity for sustainability by common people among us. These activities could be in the domain of farming, energy, water, health, medicine, entertainment, handcrafts, transport, electronics, village skills, greener technologies etc., mostly driven by necessity or curiosity of the people in the informal sector. These innovations generally offer promising new ideas and practices, but often struggle to scale up and spread beyond certain boundaries. Sometimes they offer a solution at one place, but the solution may not work everywhere due to lack of flexibility in the design. Sometimes they are either under-designed or over-designed. Sometimes materials used are not the required grade. Sometimes mechanisms used are not sufficiently efficient to deliver the required output. They are basically to be seen as bottom-up solutions that respond to the local situation and the interests and values of the communities involved. This fact is to be expected because the grassroots innovators are not trained engineers and they developed these innovations from trial and error out of their sheer zeal and local infrastructure available to them. If no intervention is done, their innovations will remain limited to their vicinity, most of the time to themselves. They do not have means and mechanisms to take their innovation to a larger scale and commercialize them for greater benefit across the country. Realizing this, INAE had set up the Frugal Innovation Nurturing Program (FINP) committee under the Chairmanship of Dr V Bhujanga Rao in late 2018. INAE had signed an MOU with National Innovation Foundation (NIF) in this connection.

The Committee shall identify suitable innovations with the help of NIF that have reached prototype stage and have been successfully tried in the field but were limited in out-reach in terms of infrastructure/means available with the inventor. Then the committee will organize design up gradation / adaptation for production in the industry, with participation of an industry in the field, address mass scale production, cost reduction and widespread dissemination of the information. The committee will fill the gap between the innovator, industry, and the end user with the help of S&T institutions, Agricultural universities, Krishi Vigyan Kendra's etc.

INAE has allocated to the tune of 20 Lakhs / annum for a period of three years (2019-20, 2020-2021, 2021-22) with provision for extension after a review. Director, NIAS, Bangalore has been requested to provide necessary technical and administrative support.

The present status is as follows:

- a) Project Completed: Improved the design of a paddy planter from TRL 5 to TRL 8 of a grassroots inventor for commercialization purpose with the support of IISc faculty. NIF is also involved throughout the work. M/s John Deere India has agreed to manufacture and market this product across India. John Deere signed agreement to this effect with the grassroot Innovator by paying the agreed royalty. This is the result of efforts as part of FINP.
- b) Projects under completion as on 31 July 2021:
 - Intelligent Glasses for the profoundly blind MVJ College of Engineering
 - Walnut peeler/ cracker II Sc, Bangalore
 - Manual Paddy Transplanter BMS College, Bangalore
 - Laddu Making Machine. MVJ College of Engg

- Solar Iron on cart RVS College of Engineering
- Automated Agri Pesticide Sprayer MVJ College of Engineering

Some more projects are under consideration by various institutions located in different cities, but the progress got affected by the pandemic. It is proposed to complete 25-30 projects as part of this program and submit a study report to agencies like DST for scaling up all grassroots innovations in the country.

INAE's 34th Foundation Day Celebrations

On the occasion of the 34th Foundation Day on April 20, 2020, a Message was forwarded by Dr Sanak Mishra, the then President, INAE to the Fellowship and Young Associates wherein he highlighted the commitment of the Academy to the efforts of Government of India in the fight against the COVID-19 Pandemic, as expressed vide his letter addressed to Dr Pramod Kumar Mishra, Principal Secretary to the Prime Minister. Subsequently, the INAE Fellowship and INAE Young Associates were requested for relevant expertise in the concerned engineering fields to offer their expertise to mitigate any dimension of the COVID 19 Pandemic from engineering perspective. The inputs received were communicated vide a letter to Prof Ashutosh Sharma, Secretary, DST with the objective of making meaningful contributions to the various measures and initiatives of the Government by providing the pertinent technical inputs to synergize the efforts, with innovative engineering interventions and providing consultancy in concerned fields, which has been appreciated.

It was also brought out that since the raising of the Academy, INAE has undergone a change in terms of the increase in its visibility in the national engineering domain. In the recent past, INAE is recognized as an advisory body to the Government Departments/Agencies for providing inputs for engineering interventions to help solve problems on topics of current engineering interest and in framing of national policies on identified areas. To facilitate the interface with the Government, INAE has in place joint Consultative Committees with Department of Science and Technology (DST) and Office of Principal Scientific Advisor (PSA) to the Government of India, which meet periodically to deliberate and identify topics of interest to the Government, to align future activities of the Academy accordingly.

Dr Sanak Mishra also gave a brief overview of the major activities/programs of the Academy since inception. He mentioned that INAE has embarked on a journey of progress over the decades with the institution of novel events and activities encompassing all aspects and fields of engineering and technology and promoting of engineering education which is vital for the growth of the engineering profession. He briefed that INAE that had launched a quarterly journal "INAE Letters" published by M/s Springer in the year 2016. The objective of the journal was to provide a medium for rapid publication of new research results and invited short review articles across different domains of engineering science and technology. In the year 2020, the title of the Journal has been changed to "Transactions of Indian National Academy of Engineering – International Journal of Engineering and Technology" and has become a full-fledged journal to include full Research Papers and Review Articles besides short communications. The Fellows and Young Associates were requested for inputs in popularizing the journal and soliciting submission of high-quality research papers.

In the Foundation Day Message, Dr Sanak Mishra highlighted the achievements in the recent conduct of the flagship events of the Academy viz. Engineers Conclave 2019; Youth Conclave 2019 and National frontiers of Engineering Symposium 2019. He was happy to mention that INAE has recently instituted the award titled as "INAE Woman Engineer of the Year Award". The purpose of the award is to recognize and honour our women engineers every year, who have made outstanding contributions to engineering/technology in India and who will serve as role models. The digitization efforts undertaken under the aegis of the INAE Digital Platform were exemplified.



The Message also brought out a novel initiative of INAE at national level viz the creation of the Frugal Innovation Nurturing programme, set up with the aim of nurturing prospective frugal grassroot technologies which have reached prototype stage and to commercialize them for the benefit of the citizens, as well as to promote the young innovators. The efforts of the Local Chapters were lauded and the joint AICTE -INAE Schemes to promote engineering education in the country were touched upon.

Dr Sanak Mishra appreciated that all activities had been realized with the active and noteworthy contributions of the INAE Fellows and the same are acknowledged not only by the Academy, but these efforts have been acclaimed at the highest national levels. He sought continued co-operation and commitment of the Fellowship in the future activities of INAE, some of which were deferred due to the current situation in the face of the COVID -19 Pandemic. The Message concluded with wishes for the good health of all.

Celebration of “Azadi Ka Amrit Mahotsav”

Subsequent to the launch of *Azadi ka Amrit Mohotsav* by the Government on 12th March 2021 at multiple places, a meeting of Prof Ashutosh Sharma, Secretary, DST with all Autonomous Professional Bodies under DST was held on 12th March 2021 regarding celebration of India’s 75th Year of Independence (Aazadi ka Amrut Mahotsava) will fall on 15th August 2022, exactly after 75 weeks from now.

With a view to discuss the events to be organized by INAE in the next 75 weeks until 15th August 2022, a 10-member Task Force has been constituted to design and monitor the specific programs that INAE would pursue in the next 75 weeks in different locations and occasions. The composition of the said Task Force is as under.

1. Dr. Sanak Mishra, Immediate Past-President, INAE (Chairman)
2. Prof. Indranil Manna, President, INAE
3. Dr. BN Suresh, Past-President, INAE
4. Dr. PS Goel, Past-President, INAE
5. Dr. Purnendu Ghosh, Vice-President, INAE
6. Prof. Sivaji Chakravorti, Vice-President, INAE
7. Prof. S Gopalakrishnan, FNAE, Governing Council Member and Secretary, INAE Bangalore Local Chapter
8. Prof. Debatosh Guha, FNAE and Secretary-cum-Treasurer, INAE Kolkata Local Chapter
9. Prof. K Muralidhar, FNAE, Chairman, INAE Kanpur Local Chapter
10. Dr. Ram Kumar Singh, FNAE, Visiting Professor, Indian Institute of Technology-Bombay

In addition, the following three INAE Young Associates have also volunteered themselves to contribute to the DST’s initiative on *Aazadi ka Amrit Mohotsav* and have been invited to form part of the sub-committee to function under direction of the Task Force.

1. Dr. Raghvendra Kumar Chaudhary, Department of Electronics Engineering, Indian Institute of Technology (Indian School of Mines), Dhanbad.
2. Dr. Mudrika Khandelwal, Dept of Materials Science and Metallurgical Engg., Indian Institute of Technology Hyderabad.
3. Dr. Sathesh Mariappan, Department of Aerospace Engineering, Indian Institute of Technology Kanpur.

All INAE Local Chapters have been requested to forward proposals regarding suitable Chapter activities/events to commemorate **India's 75th Year of Independence (Aazadi ka Amrit Mahotsav)**. The 1st meeting of the INAE Task Force for “Aazadi ka Amrit Mohotsav” was held on 31st March 2021 to discuss the way forward.

To commemorate **Azadi ka Amrit Mohotsav**, DST has decided to publish a compendium of most significant scientific and technological achievement of India since independence. The Secretary DBT, Chairperson of the Sectoral Group of Secretaries (SGoS) has requested all Science and Engineering Academies of the country including INAE to join hands and produce an encyclopaedia containing all those feats in Science & Technology that make us proud and will inspire future generations. INAE have volunteered to propose a list of engineering feats that should qualify a mention and citation in this proposed volume. INAE has initiated an action to solicit suggestions from its Fellowship to prepare a list of 75 engineering marvels (individual or collective) covering civil construction (building, bridge, railway, dam, barrage, road), space exploration (Mars and Moon mission, satellites, launch vehicles), atomic energy (Tarapur plant, Pokhran blast, fast breeder reactor), bio-medical devices (Jaipur foot), defence (missile, radar, armour), agriculture (green and white revolution), pharmaceutical, automobile, metallurgy, chemical technology, information technology, software, design, etc. (in terms of novelty, uniqueness, utility, impact, size, volume, economy, etc.).



INAE Youth Activities

INAE Youth Forum

INAE had created a Youth Forum in the year 2017 with the objective of facilitating the engagement of Indian youth in engineering activities at national level. Through the institution of the Youth Forum, INAE extends Student Membership to winners of various competitions conducted for engineering students such as National Online Essay Competition, Innovative Student Project Awards and also other competitions under the aegis of the Youth Forum, thereby endorsing their talent and advocating their ability to contribute meaningfully to the development of the country. The Youth Forum provides a platform for the engineering students to voice their concerns on engineering aspects and also interact with INAE Fellows and Young Associates on issues of national interest that shall help shape their future careers in the engineering profession. The INAE Youth Forum was launched during the first INAE Youth Conclave held at Birla Institute of Scientific Research Jaipur on Aug 11-12, 2017.

The fourth INAE Youth Conclave 2020

Due to unprecedented circumstances on account of COVID pandemic, INAE Youth Conclave 2020 could not be organized.

INAE Study Group on Indian Engineering Heritage- Metallurgy

The Workshop on “Advanced Characterization of Ancient Metallic Objects” was planned to be held on April 3-4, 2020 at Institute of Rajasthan Studies, Janardan Rai Nagar Rajasthan Vidyapeeth (Deemed -to -be) University, Udaipur. The objective of the event was to present the advanced techniques for characterization to the metallurgists and others working on ancient metallic objects and to initiate a proposal for digitization of huge characterization data available in the country on ancient Indian metallic objects. This was followed by site visits to zinc and copper heritage metallurgical sites.

In view of the unprecedented global crisis due to the pandemic caused by COVID-19, the event planned at Udaipur could not be undertaken as it involved site visit to ancient metallurgical activity zones combined with lectures by specialists.



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) 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.

The nominees for the subject Fellowship should have a minimum of 5 years' service left in the parent organization. The Fellowship amount is Rs 25,000/- per month in addition to salary being drawn and a Research Grant of Rs.15.00 lakh per annum will also be provided. An Overhead of Rs.1.00 lakh per annum will also be provided to the host institute. A Maximum of 10 Fellowships will be awarded per year. The duration of the Fellowship will be initially for three years, extendable by up to two more years depending on the performance and the Fellowship can be held for a maximum of 5 years.

A maximum of 10 Fellowships are awarded in a year. So far, six Fellowships were conferred in the Financial Year 2017- 18, eight in the Financial Year 2018-19, seven in the Financial Year 2019-20 and six nominees selected during the Financial Year 2020-21 as per details given below.

1. **Prof. Mihir Kumar Purkait**, Head, Centre for the Environment and Professor of Chemical Engineering Department, Indian Institute of Technology Guwahati conferred for his proposal on ***“Prototype Development for Catechins Extraction and Production of Low-Cost Antioxidant Tablets and Capsules”***.
2. **Prof. Shantanu Bhattacharya**, GVMM Chair and Professor, Manufacturing Science Laboratory, Department of Mechanical Engineering, Indian Institute of Technology, Kanpur conferred for his proposal on ***“Disruptive nanotechnology driven innovation for Treatment of Textile Wastewater: Proposal to Scale up existing pilot plant of 10KLD (kilo-liter/day) to real needs of Textile Industry”***.
3. **Prof. Preeti Rao**, Professor, Department of Electrical Engineering, Indian Institute of Technology Bombay conferred for her proposal on ***“Development of Instrumental Measures for Oral Skill in Any Language Based on Automatically Computed Speech Signal Parameters”***.
4. **Prof. Shiv Govind Singh**, Professor, Department of Electrical, Engineering, Indian Institute of Technology Hyderabad conferred for his proposal on ***“Early Detection of C3 And C3a Proteins from the Eye Vitreous of Elderly Person for The Diagnosis of Age-Related Macular Degeneration (AMD) and Monitoring Treatment Response”***.
5. **Dr. Gaurab Banerjee**, Associate Professor, Electronics and Communication Engineering (ECE) Department, Indian Institute of Science, Bangalore conferred for his proposal on ***“Design, Development and Commercialization of Radar-On-Chip Technology”***.
6. **Prof. Srinivasan Raghavan**, Professor, Centre for Nano Science and Engineering, Indian Institute of Science, (IISc) Bangalore conferred for his proposal on ***“Beyond AlGaIn-GaN High Electron Mobility Transistors for Power and RF Electronics: ScAlN Technology Development for RF Filters and Nitride Electronics”***.

Besides above, as per the guidelines of the Fellowship, “The duration of the fellowship will be initially for three years, extendable by upto two more years depending on the performance. The fellowship can be held for a maximum of 5 years.” Accordingly, six fellows who were conferred for the fellowship during 2017-18 completed three years of tenure and were reviewed for the extension during the Search Cum Selection Expert Committee Meeting held on August 7, 2021. The following fellows were granted the extension for two years by the Committee:

1. **Prof Sirshendu De, Department of Chemical Engineering, Indian Institute of Technology, Kharagpur** was conferred with Abdul Kalam Technology Innovation Fellowship for his proposal to develop *“processes with prototype building & field trial on fluoride removal from groundwater; removal of heavy metals from groundwater; removal of cyanide from steel plant effluent and scaling up of cold sterilization technique for storing tender coconut water with high shelf life using suitable membranes”* during the Search Cum Selection Expert Committee meeting held on September 25, 2017. The tenure of his fellowship was initially for the period of three years with effect from January 1, 2018 i.e. from January 1, 2018 to December 31, 2020, and he was granted an extension of two additional years starting from January 1, 2021- December 31, 2022.
2. **Prof Krishnan Balasubramanian, Department of Mechanical Engineering, Indian Institute of Technology Madras** was conferred with Abdul Kalam Technology Innovation Fellowship for his proposal for carrying out work on *“Developing of the Ultrasonic Waveguide Sensor Systems”* during the Search Cum Selection Expert Committee meeting held on Sept 25, 2017. The tenure of his fellowship was initially for the period of three years with effect from January 1, 2018 i.e. from January 1, 2018 to December 31, 2020, and he was granted an extension for a period of two additional years starting from January 1, 2021- December 31, 2022.
3. **Prof GK Ananthasuresh, Department of Mechanical Engineering, Indian Institute of Science, Bangalore** was conferred with Abdul Kalam Technology Innovation Fellowship for his proposal for carrying out work on *“developing of the following viz. In-situ soil-moisture sensor; Intracranial pressure sensor and chair for the elderly and arthritics”* during the Search Cum Selection Expert Committee meeting held on Sept 25, 2017. The tenure of his fellowship was initially for the period of three years with effect from January 1, 2018 i.e. from January 1, 2018 to December 31, 2020, and he was granted an extension for a period of two additional years starting from January 1, 2021- December 31, 2022.
4. **Prof Navakanta Bhat, Centre for Nano Science and Engineering, Indian Institute of Science, Bangalore** was conferred with Abdul Kalam Technology Innovation Fellowship for his proposal for pursuing the research on *“Nanostructured Semiconductor Gas Sensors with prototype building & Field Trials: New materials and device structures for highly sensitive and selective gas sensors; Optimization of single chip gas sensor array for multiple gas sensing and processing gas sensors in a cleanroom and calibration of gas sensors”* during the Search Cum Selection Expert Committee meeting held on March 10, 2018. The tenure of his fellowship was initially for the period of three years, with effect from April 1, 2018 i.e. from April 1, 2018 to March 31, 2021, and he was granted an extension for a period of two additional years starting from April 1, 2021- March 31, 2023.
5. **Prof Sudipta Mukhopadhyay, Department of Electronics and EC Engineering, Indian Institute of Technology Kharagpur** was conferred with Abdul Kalam Technology Innovation Fellowship for his proposal for pursuing the research on *“Real Time Image Enhancement: Rain and Fog Removal from Videos with software/technology development and Field Trials on development of Embedded rain and fog removal software solutions with appropriate interface and Algorithms beneficial in ADAS (Advanced Driver Assistance Systems) to improve the safety in various transportation systems and outdoor video coverage”* during the Search

Cum Selection Expert Committee meeting held on March 10, 2018. The tenure of his fellowship was initially for the period of three years with effect from April 1, 2018 i.e. from April 1, 2018 to March 31, 2021, and he was granted an extension for a period of two additional years starting from April 1, 2021- March 31, 2023.

6. **Dr Abhishek, Associate Professor, Department of Aerospace Engineering, Indian Institute of Technology Kanpur** was conferred with Abdul Kalam Technology Innovation Fellowship for his proposal for pursuing research on *“various aspects of Aerospace Technology with prototype building/ Field Trials and commercialization of Rotary Wing Unmanned Aerial Vehicle with 5Kg and 10kg payload capacity; High efficiency Vertical Axis Wind Turbine with dynamic blade pitching and Hybrid Multirotor Convertiplane UAV”* during the Search Cum Selection Expert Committee meeting held on March 10, 2018. The tenure of his fellowship was initially for the period of three years with effect from April 1, 2018 i.e. from April 1, 2018 to March 31, 2021, and he was granted an extension for a period of two additional years starting from April 1, 2021- March 31, 2023.

Besides above, the other recipients of the subject fellowship are listed below who have been selected during 2018-19 and 2019-20 respectively:

Nominees selected during 2018-19

1. **Prof B Ravi, Department of Mechanical Engineering, Indian Institute of Technology Bombay** was conferred for his proposal for carrying out research on *“Accelerating Medical device innovation and to develop, commercialize and create social impact through two innovative medical products for diagnosis of disease and effective treatment”*.
2. **Prof PV Madhusudhan Rao, Department of Design, Indian Institute of Technology Delhi** was conferred for his proposal for carrying out research on *“Medical and Assistive Devices and to develop Tactile Diagrams for the Visually Impaired and Training, capacity building and dissemination of technology developed”*.
3. **Prof Amrutur Bharadwaj, Department of Electrical Communication, Indian Institute of Science, Bangalore** was conferred for pursuing research on *“Streetcloud for autonomous drones with the objective of using the smart city’s Street cloud Infrastructure to support autonomous drone fleets through hardware design of Pole Compute and Communication Platform”*.
4. **Prof G Kumaraswamy, Principal Scientist, Polymer and Advanced Materials Laboratory, CSIR -National Chemical Laboratory, Pune** was conferred for carrying out research on *“3D printing of ceramics, metals and composites using aqueous inks with a view to develop aqueous colloidal solutions as inks for 3D printing of ceramics, metals composites”*.
5. **Prof Samir K Pal, Senior Professor, Department of Chemical, Biological & macromolecular Sciences, SN Bose National Centre for Basic Sciences, Kolkata** was conferred for his proposal for carrying out research leading to *“Large Scale Validation and Field Trials of an Indigenous Non-Invasive Non-Contact Robust Portable Hand -held Device for accurate measurement of Bilirubin level, Hemoglobin concentration and Oxygen saturation in Neonatal Subject”*.
6. **Dr G Padmanabham, Director, International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI), Hyderabad** was conferred for his proposal for carrying out research work on *“Metal Additive Manufacturing (AM) for Repair and Reclamation of Aerospace Components”* leading to development of indigenous, novel and affordable technologies and products”.

7. **Prof Sudip Misra, Department of Computer Science & Engineering, Indian Institute of Technology (IIT) Kharagpur** was conferred for his proposal for pursuing the research on *“Ambulatory Sensing and Point-of-Care Recommendation for IoT – Based Healthcare”* leading to development of smart systems using medical analytics.
8. **Prof Ashwini Kumar Agrawal, Head, Department of Textile Technology, Indian Institute of Technology (IIT) Delhi** was conferred for his proposal for carrying out research work on *“Next Generation Filtration Devices for Protection of Environment and Health”* leading to development of prototypes and devices.

Fellows selected during year 2019-20

1. **Prof. Rohit Srivastava, Head, Department of Biosciences and Bioengineering, Indian Institute of Technology Bombay, Powai, Mumbai** was conferred for his proposal for carrying out research work on *“U can’- World’s first self-cervix screening device”* leading to portable hand- held solution, which any individual can use with minimum training.
2. **Prof Pushpak Bhattacharyya, Director, Indian Institute of Technology Patna, IIT Patna Main Campus, Amhara, Bihta** was conferred for his proposal for pursuing the research on *“Shushrut”- a system for increasing efficiency and diagnosis-accuracy of clinical workflow in Indian radiology using Automatic Speech Recognition and Natural Language Processing* leading to development of a suite of tools to reduce the burden of report generation on radiologists in India, so that they can concentrate on diagnosis only.
3. **Prof. V Kamakoti, Senior Professor, Department of Computer Science & Engineering, Indian Institute of Technology Madras** was conferred for his proposal for carrying out research work on *“Design of SHAKTI based secure Micro-processor”* leading to development of Processor System-on-Chip (SoC).
4. **Prof. Sujatha Srinivasan, Department of Mechanical Engineering, and Head, TTK Center for Rehabilitation Research and Device Development, Indian Institute of Technology Madras** was conferred for her proposal for carrying out research work on *“Design and commercialization of an indigenous lever-operated orthotic knee”* leading to development of an easy-to-operate affordable locked knee joint for Knee Ankle Foot Orthosis (KAFO).
5. **Prof. Subhananda Chakrabarti, Department of Electrical Engineering, Indian Institute of Technology Bombay, Powai, Mumbai** was conferred for his proposal for pursuing the research on *“Development of high resolution and large format (640X512 and 1KX1K) prototype Thermal imagers for night vision and surveillance applications”* leading to development of completely indigenous prototypes of large format, thermal imagers for night vision and surveillance applications.
6. **Prof. Bikramjit Basu, Professor, Materials Research Center, Indian Institute of Science, Bangalore** was conferred for his proposal for carrying out research work on *“Design, manufacturing, pre-clinical validation of novel metallic/ceramic dental implants”* leading to development of dental implant in India and to provide globally competitive dental implants at lower cost.
7. **Prof. Debatosh Guha, Professor, Institute of Radio Physics and Electronics, University of Calcutta** was conferred for his proposal for carrying out research work on *“Development of Metasurface Enabled Multifunction Antennas for Medical and 5G Applications”* leading to development of a novel metasurface based antenna technology to satisfy the special requirements of modern 5G communications and medical applications with improved performance.

So far total of twenty-seven nominees have been selected for conferment of the subject Fellowship since its inception. The Fellowship is receiving a good response and is progressing well with each passing year.



Reaching out to Policy Makers: Interaction with Government Agencies

Indian National Academy of Engineering (INAE), during the recent past, in addition to its well-defined activities, has been giving a major thrust in carrying out activities on issues of National importance, where engineering interventions can provide the needed solutions. In order to facilitate identification of topics on thrust areas for conduct of activities, INAE has in place consultative/joint Committees with DST, Office of Principal Scientific Adviser (PSA) to Government of India, TIFAC, AICTE etc. The actionable recommendations emanated from the activities have been forwarded as inputs for policy formulation, to the concerned agencies, which have been well received and, in many cases, implemented. The progress made by INAE on some of these activities are summarized below.

DST-INAE Consultative Committee

Joint Consultative Committee was constituted with DST to identify topics for aligning of activities and programmes of INAE with thrust areas of national engineering interest. Towards this end, following activities have been undertaken and are being progressed:

(a) Study on “Pilot Project on Safe Laboratory Practices and Laboratory Waste Disposal”

During one of the DST-INAE Consultative Committee Meetings, Prof. Ashutosh Sharma, Secretary, DST entrusted the task to INAE for creating a plan of action to enhance the awareness of health and safety issues and safe disposal of chemicals and solvents in chemical and biological laboratories in Indian universities, research institutes and colleges.

Accordingly, the Study was undertaken entitled, “Pilot Project on Safe Laboratory Practices and Laboratory Waste Disposal” by Dr. S Sivaram, FNAE as the Principal Engineering Investigator (PI) and Dr. G.S. Grover, Chief Scientist (Retd), CSIR-National Chemical laboratory, Pune; as Team Member and Consultant and Mr. Shankar B. Kausley, TCS Pune as Team member. After deliberate efforts, a report on the Pilot project on “Safe Laboratory Practices and Laboratory Waste Disposal” was completed and submitted to DST.

The objective of the project was to create a plan of action to establish best practices for the disposal of chemical and hazardous wastes in the chemical and biological laboratories of universities, colleges, and research institutions in India. The report covered the following topics:

- Hierarchy of controls in safety management
- Methodology
- Elements of safety check list
- Five-levels of laboratory safety and attributes
- Budgetary estimates for upgradation of laboratory safety and recommended implementation strategy.

A presentation has since been made by Dr Sivaram to Prof Ashutosh Sharma during one of the meetings of DST-INAE Consultative Committee and the following points emanated:

- (a) DST is making a framework for ranking and rating of institutions, with respect to gender, equity, and inclusion and that a similar system may be evolved for safety ranking of institutions. Dr S Sivaram responded that the study has in place, a firm framework for analysis and ratable parameters to facilitate ranking of safety levels of institutions, at any point of time.

- (b) The implementation of the recommendations may be done either by making safety as a part of national ranking of institutions or by enforcing mandatory budgetary allocation of 1-2 percent on safety head, with documented evidence and suitable policy interventions.
- (c) A methodology for creating resources for scaling up of safety levels of institutions be evolved suitably.
- (d) Internal standards for safety for construction of new laboratories in institutions should be mandatory and recommended best practices be laid down.
- (e) Regulation and measures of incentivization in terms of ranking and funding may be considered and a share of the research budget be allocated for upgrading of safety of existing laboratories.
- (f) A full credit course with model curriculum be developed on safety which should be compulsory for all students.
- (g) The most essential elements for retrofitting of existing laboratories through minimum interventions be identified for each institution, to upgrade the safety levels of institutions.
- (h) A scientific code needs to be evolved that should be mandatory while sanctioning a DPR. He suggested that DST partners scientifically and financially with Ministry of Education to support this activity. It was suggested arranging a meeting with Secretary, Department of Education to sensitize them to specify safety norms while submission of Detailed Project Reports (DPRs) for new campuses.
- (i) No project should be sanctioned to any laboratory, without certification by the institute of allocation of a fixed percentage of budget for adoption of safety standards.
- (j) It was highlighted that the two main issues are retrofitting of laboratories with minimally prescribed standards. A view may be evolved that no DST, SERB grant would be sanctioned without certification by the Director, that minimum safety standards are being adopted within a time frame of 1-2 years and a stipulated budgetary allocation of 2 percent for the same.

It was emphasized that the implementation of rating, ranking and best practices in institutions may be driven through Department of Education, initially, through voluntary surveys and later made mandatory to obtain requisite data to affect improvement in safety levels.

(b) Research Study on “Housing”

DST had desired INAE to undertake a Research Study for providing optimal engineering solutions for Housing under “Jan Awas Yojna” announced by the Hon’ble Prime Minister of India. Accordingly, INAE Forum on Civil Infrastructure, chaired by Prof. Prem Krishna, Former Vice-President, INAE had deliberated and submitted a proposal on ‘Housing’ to INAE with an objective to create a “White Paper” to provide a set of needed actions related to Policy Initiatives, Engineering R&D and Extension.

Prof Prem Krishna gave a brief presentation on the study during one of the meetings of DST-INAE Consultative Committee and briefed that substantial progress has been made in the study, and the report will be completed shortly. He mentioned that considering the sizeable gap between demand and availability, the Forum is recommending- Industrialized Mass Housing as the preferred approach. R&D, Standardization and Policy Initiatives needed to accelerate the adoption of Mass Industrialized Housing are recommended, along with improvement in technologies and suitability for different parts of the country. Prof Prem Krishna also brought out that it is proposed to involve the Bureau of Indian Standards (BIS) since, if large scale construction is done at fast rate, there can be an issue of scatter in quality. It has been suggested to BIS to start the process for preparation of standards for the technologies for Mass Industrialized Housing, for good quality construction.

During the meeting it was brought out that it is essential to evolve the standards and examine the efficacy of the proposed technologies vis-a-vis prevailing technologies. The report on the Housing is under preparation and shall be submitted shortly to DST.

(c) INAE Vision Document 2020-25

At the behest of DST, INAE has prepared INAE Vision Statement 2020-25 for the next 5 years wherein INAE has identified five thrust areas of national importance to prioritise; which are (i) Development and Deployment of Novel Materials for components and devices used in particularly for strategic sectors like Defence, Atomic Energy and Space for which INAE already had instituted an Expert Group wherein the representation from DRDO is also in place; (ii) Strategies for Energy Transition on Fossil Fuels free Renewable Energy Sources to be used as alternate energy source; (iii) Engineering Education which would focus on higher education and not undergraduate education. The focus will be Engineering Innovation and research like Post-Doctoral research in India (iv) World Class Infrastructure where the focus will not only be restricted to smart cities but to achieve modern Infrastructure in terms of logistics, Digital Technology etc.; (v) Cyber-Physical Systems wherein it is recommended to include engineering dimensions in quantum computing.

(d) National Science, Technology & Innovation Policy (STIP 2020)

Office of the Principal Scientific Adviser (Office of PSA) to the Government of India and the Department of Science and Technology (DST) were engaged in the process of formulating India's 5th National Science, Technology, and Innovation Policy (STIP 2020). INAE was requested to provide views, suggestions, and other inputs as an institution on the proposed policy which were compiled and forwarded to DST.

PSA-INAE Consultative Committee

A meeting of PSA-INAE Consultative Committee was held and the development regarding Regional Transport Aircraft (RTA) was discussed. INAE delegation comprising of Dr Sanak Mishra, President, INAE; Dr BN Suresh, Immediate Past -President, INAE; Dr Kota Harinarayana, Former DG, ADA and Dr PS Goel, Former President, INAE met Hon'ble Minister of Civil Aviation, Shri Hardeep Singh Puri. The recommendations were very well received. Dr PS Goel briefed the Committee on INAE Pursuit and the status of progress so far on the development of Regional Transport Aircraft since 2016. After detailed deliberations, Prof. K VijayRaghavan, PSA to GOI has recommended the following actions to take this initiative forward:

- There is an Empowered Technology Group (ETG) instituted in the office of PSA which have an objective to encourage development and institution of such projects. This group would also enable in implementation of this project.
- A dedicated Program Management Group chaired by the PSA and representation from various stakeholders would be constituted.
- There is a requirement to explore the possibility for the way forward with the Cabinet Secretary along with DG, CSIR. For this, the PSA has agreed to hold a meeting with the Cabinet Secretary along with DG, CSIR and MoCA (Ministry of Civil Aviation).
- This Program Management Group would facilitate to intensely drive the Agenda to take this project of development of RTA in a structured manner with the help of high-level members from INAE and other concerned agencies like MoCA etc. This will enable to keep timelines and follow ups in place.
- This Group is also envisaged to submit the report periodically to the Cabinet Secretary and to the PMO on the progress of this task.

A meeting of the President, INAE along with the PSA and DG, CSIR was held on February 4, 2021 with the Cabinet Secretary so as to discuss the way forward.

DRDO-INAIE Consultative Committee

INAIE has recently instituted DRDO-INAIE Consultative Committee. The first meeting of the Committee was held on November 12, 2020. Besides briefing of activities and recent initiatives undertaken by INAE, a major discussion was held on the “Recommendations arising from Theme I on “Defence Technology and Innovation” deliberated at Engineers Conclave 2019 held at Bengaluru. The seventh Engineers Conclave 2019 (EC-2019) was organized jointly with Bharat Electronics Limited (BEL) on Sept 19-21, 2019 at BEL Academy of Excellence (Nalanda), Bangalore.

The two themes of EC-2019 were “Defence Technology & Innovation” coordinated by BEL and “Transformation of Rural India Using Digital Technologies” coordinated by INAE. The Chief Guest of the event was Hon’ble Raksha Mantri Shri Rajnath Singh. The recommendations had since been received from the Coordinators of both the themes and suitably compiled and published. The theme #1 on Defence Technology & Innovation was organised to focus on policy related issues to create wider base of defence R&D and Innovation in the Industry and Academia in the spirit of “Atmanirbhar Bharat”, with active participation of DRDO.

The recommendations on the Technical Sessions on Theme – I on “Defence Technology and Innovation” which included the sub-themes on Emerging Technologies & Trends for Defence, R&D in Defence, Policies, Growth Drivers and Skill Development, Strategic Partnerships/ Enabling International Cooperation and Success Stories & Way forward. The observations and Recommendations pertaining to the (i) Defence R&D Policy; (ii) Procurement Policy and; (iii) Defence R&D Funding were deliberated in detail.

It was also emphasized that the DRDO has incorporated some of the recommendations in new Defence Acquisition Procedure (DAP) 2020 and it was considered that is an especially important issue from the DRDO and defence preparedness perspective in the future. A way forward and detailed progress shall be made in subsequent meetings to follow.

CSIR-INAIE Consultative Committee

CSIR-INAIE Consultative Committee is another recent initiative by INAE. The first meeting of the Committee was held on February 4, 2021. It was agreed that since INAE has a wider mandate of creating and influencing policy to promote engineering and technological growth in India, CSIR would like to seek help from INAE in creating policy papers on futuristic issues. CSIR can help to take these policy recommendations to the Government. A few of these futuristic issues mentioned are as follows: Clean Hydrogen; Carbon Capture; Future of Communication; Future of Mobility; Promoting education in engineering and technology at higher level and enhancing the skills of young engineers from Industries.

The Committee also discussed and identified joint initiatives/areas which may be considered for further scaling up as joint activities between INAE and CSIR subsequently. Three important ideas were suggested to be taken up jointly (i) Creation of White Papers in selected technology areas, (ii) Instituting CSIR-INAIE Chair Professorship and Scholarship, (iii) INAE-CSIR joint research projects for engineering students/scholars that can be funded by CSIR. An Expert Group be constituted that will seek, examine and select projects worth pursuing and come up with the recommendations and policies which could be seriously pursued through this joint group. A few domains be suggested by CSIR which could be pursued through BTech, MTech and Ph.D level project thesis. These students can take up the projects in Groups and can demonstrate a live model/product so as to come up with a tangible outcome. All above suggestions are being progressed.



Research Schemes

INAE Chair Professorship

INAE Chair Professorship was instituted in order to encourage engineers/technologists with outstanding research contributions, promote long-term participation in academic research and enhance the research standards in academic institutions. INAE Fellows between the ages of 45 and 65 years, working in well-recognized teaching/research institutions in India are eligible for consideration.

The nominations were not invited during the year since it was decided to review the methodology for inviting and processing the nominations and other details of the INAE Chair Professorship scheme with a view to enhance its impact and solicit more nominations.

INAE Distinguished Professors/Technologists

INAE Distinguished Professors/Technologists Scheme has been instituted in order to utilize the expertise of INAE Fellows after superannuation for research in engineering institutions/Universities/Research & Development establishments/industry in India. Superannuated Fellows below 70 years of age are eligible for consideration.

The nominations were not invited during the year since it was decided to review the methodology for inviting and processing the nominations and other details of the Distinguished Professors/Technologists Scheme with a view to enhance its impact and solicit more nominations.

Dr P Chellapandi has been conferred as INAE Distinguished Professor/Technologist for the period April 1, 2019 to March 31, 2022. The research work is being carried out at Indian Institute of Technology, Madras. The topic is “Development and application of a numerical analysis method for investigating hydro static and hydrodynamic responses of pocket bearing Rotor Systems”.

The summary of research carried out by him during the year 2020-2021 is given below.

A numerical tool is presented for simulating the dynamics of a vertical rotor attached with pocket bearing assembly immersed in a liquid pool. The journal of the bearing has a heterogeneous geometry with the presence of pockets and grooves. The fluid pressure supplied to the pockets is a quadratic function of shaft speed. The radial, circumferential and axial flow paths constitute a complex fluid network in the coupled system. The network has been conceived as an assemblage of straight and curved fluid flow paths for the generic applications. An efficient solution strategy has been employed involving both analytical and numerical techniques. A case study was performed on a representative pocket bearing assembly that is commonly used in the coolant pumps of sodium cooled fast reactor. The study has brought out some specific dynamic characteristics of such bearings. The flow field exhibits both hydrostatic and hydrodynamic effects, thereby hybrid bearing characteristics. The dynamic characteristics are strong function of spinning velocity, eccentricity, and angular orientation of the rotor in fluid annulus. Based on an elaborate parametric study, a rotor dynamic stability chart has been established for the practical applications. Interestingly, the dynamic behavior within a limited operating regime exhibits the characteristics of a large eccentric homogeneous rotor rotating in fluid annulus with moderate gaps. Moreover, it is found that the pocket type bearing has better stability control, mainly due to lower added fluid mass. The numerical tool is experimentally validated by comparing the displacements measured on a shaft coupled with pocket bearing assembly, rotating in a water pool.

Mentoring of Engineering Teachers by INAE Fellows

INAE undertakes mentoring of engineering teachers from recognized Engineering Institutions with a view to enhance the quality of engineering education being imparted in the country.

Due to COVID-19 Pandemic it was not feasible for the mentee (engineering teacher) to travel to the location of the Mentor/ INAE Fellow to undergo mentoring. Hence, a mentee was given the option to choose either Module I or Module II for partaking of the mentoring, as per his/her personal choice with due consent of the mentor, in either case.

Module I: Online Mentoring for a duration of 2 months:

The selected mentee (teacher) can opt to be mentored by the Mentor (INAE Fellow) online through video conference/ Skype/ Zoom/WebEx/ Video call and other similar facilities for a duration of two months.

Module II: Existing Procedure for Operation of scheme wherein Mentee Travels to Institution of Mentor for undertaking mentoring for duration of 2 months:

The mentee may opt to partake the mentoring by travelling to the institution of the mentor for a duration of two months.

A total of twenty-five engineering teachers were selected under scheme on “Mentoring of Engineering Teachers by INAE Fellows” this year, as per details given below.

S No	Name of Mentor	Institution / Organization of the Mentor	Name of Engineering Teacher	Institution of Teacher
1	Prof BB Chaudhuri	Indian Statistical Institute, Kolkata	Mr Swalpa Kumar Roy	Jalpaiguri Government Engineering College, West Bengal
2	Prof Sukumar Nandi	Indian Institute of Technology Guwahati	Mrs Sanchita Saha	Haldia Institute of Technology, Haldia, West Bengal
3	Prof Ashok Pradhan	Indian Institute of Technology Kharagpur	Mr Suman M	Motilal Nehru National Institute of Technology, Prayagraj, Uttar Pradesh
4	Prof Suman Chakraborty	IIT Kharagpur	Dr Nirmalendu Biswas	Department of Power Engineering, Jadavpur University, Salt Lake, Kolkata
5	Prof SK Koul	IIT Delhi	Dr Lalit Kumar	National Institute of Technology Calicut
6	Dr DP Kothari	SB Jain Institute of Technology Management and Research, Nagpur	Mr Rahul Dilip Jawale	Rajiv Gandhi College of Engineering and Research, Nagpur
7	Prof Sameer Khandekar	IIT Kanpur	Dr Bukke Kiran Naik	NIT, Rourkela
8	Dr Arun Kumar Bhaduri	Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam	Dr C Vanitha	National Institute of Technology, Warangal
9	Prof Sudip Misra	IIT Kharagpur	Dr Suvadip Batabyal	BITS Pilani Hyderabad Campus, Jawahar Nagar, Kapra Mandal, Telangana
10	Prof Tushar Kanti Datta	Emeritus Professor, IIT Delhi; Professor, National Centre for Disaster Mitigation, Malviya National Institute of Technology, Jaipur	Dr Pankaj Kumar	National Institute of Technology, Nagaland



S No	Name of Mentor	Institution / Organization of the Mentor	Name of Engineering Teacher	Institution of Teacher
11	Dr K G Narayankhedkaar	Former Professor and Dean (Planning), IIT Bombay and Former Director, VJTI, Mumbai	Mr Babaso Natha Naik	Walchand College of Engineering, Sangli
12	Prof Sukumar Mishra	IIT Delhi	Dr Ranjeeta Patel	Kalinga Institute of Industrial Technology, Bhubaneswar
13	Prof Madhira R Madhav	Prof Emeritus, JNTU, Hyderabad and Visiting Professor, IIT Hyderabad	Mr JYV Shiva Bhushan	VNR Vignana Jyothi Institute of Engineering and Technology, Pragati Nagar, Nizampet
14	Prof Debasish Ghose	Indian Institute of Science, Bangalore	Dr Sanat K Biswas	IIIT, Delhi
15	Prof Bayya Yeg-narayana	IIIT Gachibowli	Ms Jyotsna Devi Bodapati	Vignan Deemed to be University, Vignan's Foundation for Science Technology and Research Deemed to be University, Andhra Pradesh
16	Dr R Balasubramaniam	Bhabha Atomic Research Centre CEL-V, BARC, Trombay, Mumbai	Mr Shreeprasad Manohar	Don Bosco Institute of Technology, Mumbai
17	Dr J Krishnan	Retired L&T Chair, MS University, Baroda	Prof Vishvesh J Badheka	Pandit Deendayal Energy University, Gandhinagar
18	Prof KJ Vinoy	Indian Institute of Science Bangalore	Mr Anas MM	Govt. Engineering College, Wynad Kerala
19	Prof Hari Hablani	Retired, former Boeing Technical Fellow Westminster, CA, USA	Dr Abhirup Datta	Indian Institute of Technology, Indore
20	Prof Sukumar Nandi	Indian Institute of Technology Guwahati	Mr Bikramjit Choudhury	Central Institute of Technology, Kokrajhar
21	Dr Lalit Kumar	Distinguished Research Advisor, SIT-Tumkur, Bangalore	Mr Harish V Dixit	BITS Pilani Hyderabad Campus, Jawahar Nagar, Kapra Mandal, Hyderabad, Telangana
22	Prof SN Singh	Indian Institute of Technology Kanpur	Mr Samarendra Pratap Singh	Institute of Engineering and Technology, Dr Rammanohar Lohia Avadh University Ayodhya, UP
23	Prof Radhakant Padi	Indian Institute of Science, Bangalore	Dr Tousif Khan	SRM University AP Andhra Pradesh Neerukonda Village, Mangalagiri Road
24	Prof Bidyadhar Subudhi	Indian Institute of Technology, Goa	Dr Kshetrimayum Lochan	Manipal Institute of Technology, Manipal Academy of Higher Education, Karnataka
25	Dr Parag R Gogate	Institute of Chemical Technology, Mumbai	Prof Sandip Hasuram Gharat	Gharda Institute of Technology, Dist. Ratnagiri Maharashtra

Mentoring of Engineering Students by INAE Fellows

INAE undertakes mentoring of meritorious 3rd/4th year B.E./B.Tech students from recognized Engineering Institutions with a view to provide them guidance so as to excel further in their field of study and improve the quality of engineering education.

Due to COVID-19 Pandemic, it was not feasible for the mentee (engineering student) to travel to the location of the Mentor/ INAE Fellow to undergo mentoring. Hence, a mentee was given the option to choose either Module I or Module II for partaking of the mentoring, as per his/her personal choice with due consent of the Mentor, in either case.

Module I: Online Mentoring for a duration of 2 months

The selected mentee (engineering student) can opt to be mentored by the Mentor (INAE Fellow) online through video conference/Skype/ Zoom/WebEx/ Video call and other similar facilities for a duration of two months.

Module II: Existing Procedure for Operation of scheme wherein Mentee Travels to Institution of Mentor for undertaking mentoring for duration of 2 months

The mentee may opt to partake the mentoring by travelling to the institution of the mentor for a duration of two months.

A total of fifty nine engineering students were selected under scheme on “Mentoring of Engineering students by INAE Fellows” this year, as per details given below.

S No	Name of Mentor	Institution/ Organisation of the Mentor	Name of Engineering Student	Institution of Student
1	Prof Vinay Kumar Gupta	Indian Institute of Technology Kanpur	Mr Devasmit Dutta	IIT Bhubaneswar
2			Mr Aniruddha Das	IIT Roorkee
3	Dr Rahul Mitra	Indian Institute of Technology Kharagpur	Mr Sumantra Das	National Institute of Raipur
4			Mr Saksham Popli	IIT Indore
5	Dr Parag R Gogate	Institute of Chemical Technology Matunga, Mumbai	Mr Bhagyesh Anand Nandgawale	Bharathi Vidyapeeth College of Engineering, Navi Mumbai
6	Prof Sushmita Mitra	Indian Statistical Institute, Kolkata	Mr Sudipto Ghosh	Indian Institute of Engineering Science and Technology, Shibpur
7	Prof Krishnamurthy Muralidhar	Indian Institute of Technology Kanpur	Mr Shivanshu Singh	Indian Institute of Technology Bhubaneswar
8	Dr Jayanta Mukhopadhyay	IIT Kharagpur	Mr Utsav Bandhyopadhyay Maulik	Techno Main, Salt Lake Under Maulana Abul Kalam Azad University (Makaut), Kolkata
9	Prof Sudip Misra	IIT Kharagpur	Mr Varan Singh Rohila	National Institute of Technology, Hamirpur
10			Mr Aatish Rana	National Institute of Technology, Rourkela
11	Dr Lalit Kumar	Ex Director, MTRDC, DRDO, Bangalore	Ms Mrudula N Naik	Dayananda Sagar Academy of Technology and Management, Opp. Art of Living, Bangalore
12			Mr T Akshaya	BITS Pilani Hyderabad Campus, Hyderabad



S No	Name of Mentor	Institution/ Organisation of the Mentor	Name of Engineering Student	Institution of Student
13	Prof Nikhil R Pal	Indian Statistical Institute, West Bengal	Ms Kriti Saxena	National Institute of Technology, Warangal
14	Prof Debasish Ghose	Indian Institute of Science Bangalore	Ms Irene Grace Karot Polson	Indian Institute of Technology Kanpur
15			Ms Nandni Sharma	Punjab Engineering College, Chandigarh
16	Prof PK Dash	Siksha 'O' Anusandhan, Bhubaneswar, Odisha	Mr Sobhit Panda	College of Engineering and Technology, Bhubaneswar
17	Prof Kalvala Srinivas Reddy	Indian Institute of Technology Madras	Mr Harikesh Verma	Indian Institute of Technology, Bhubaneswar
18	Prof Pradip Dutt	Indian Institute of Science Bangalore	Ms Tanmayee Kopparthi Rama Ruchi	Indian Institute of Technology, Bhubaneswar
19			Mr Abhishek Singh	Indian Institute of Technology Mandi
20	Prof Suman Chakraborty	Indian Institute of Technology Kharagpur	Mr Arnab Paul	Jadavpur University
21			Ms Archi Agrawal	Indian Institute of Technology Roorkee
22	Prof DP Kothari	SB Jain Institute of Technology Management & Research, Nagpur	Mr Gaurav Prashant Padmagiriwar	Priyadarshini College of Engineering, Nagpur
23			Mr Yash Krupal Deshmukh	Rajiv Gandhi College of Engineering and Research, Nagpur
24	Prof G Panda	CV Raman Global University and IIT Bhubaneswar	Mr Biswajit Patra	College of Engineering and Technology, Bhubaneswar
25	Dr R Gopalan	ARCI, Chennai	Ms Lakshmi Gera	RGUKT-IIIT, NUZVID, Mylavaram Road, Krishna District, Andhra Pradesh
26			Mr Boddupalli L Kumar	Rajiv Gandhi University of Knowledge Technologies, Basar
27	Prof S Tarafder	CSIR NML Jamshedpur	Mr Syed Abdur Rahman	National Institute of Technology, Durgapur
28	Prof BS Murty	Indian Institute of Technology Hyderabad	Ms Vogulam Vennela	RGUKT, Basar
29			Ms Veera Venkata Naga Durga Bhavani Battula	RGUKT-IIIT, NUZVID, Mylavaram Road, Krishna District, Andhra Pradesh
30	Prof K Bhanu Sankara Rao	School of Engineering Sciences and Technology, University of Hyderabad	Ms Sai Silpa Bhavani Punati	RGUKT-IIIT, NUZVID, Mylavaram Road, Krishna District, Andhra Pradesh
31			Mr Panchi Reddy Janakiram	Mahatma Gandhi Institute of Technology Gandipep, Hyderabad

S No	Name of Mentor	Institution/ Organisation of the Mentor	Name of Engineering Student	Institution of Student
32	Prof Satyam Suwas	Indian Institute of Science Bangalore	Ms Cheenuri Priya	Rajiv Gandhi University of Knowledge Technologies, Basar
33			Ms Katta Ananya	National Institute of Technology, Warangal
34	Dr Samir V Kamat	DMRL, DRDO, Hyderabad	Ms Voma Shivani	National Institute of Technology, Andhra Pradesh
35			Mr B Rishik Bharadwaj	NIT Warangal, National Institute of Technology Campus. Fathimanagar, Telangana
36	Prof SV Kulkarni	IIT Bombay	Mr Rahul Madhukar Rane	Veer mata Jijabai Technological Institute, Mumbai
37	Prof Sameer Khandekar	IIT Kanpur	Mr Katakam Vishnu Sree Shanthanu	National Institute of Technology, Warangal, Telangana
38	Dr G Padmanabham	International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI) Balapur, Hyderabad	Mr S Ananthasurya	MLR Institute of Technology, Hyderabad
39			Mr Syed Mohammad Musthaq	National Institute of Technology, Andhra Pradesh
40	Prof Bijoy Bhattacharyya	Jadavpur University, Kolkata	Mr Sayan Doloi	Kalinga Institute of Industrial Technology, Bhubaneswar, Odisha
41	Prof SK Koul	IIT Delhi	Mr Munnaluru Akhila	University College of Engineering, Osmania University, Hyderabad
42			Ms Esha Goel	Shiv Nadar University, Dadri, UP
43	Prof MR Madhav	Visiting Prof IIT Hyderabad	Mr BLVVDSS Abhinav	VNR Jyothi Institute of Engineering and Technology, Hyderabad
44	Prof Sanjay Mittal	IIT Kanpur	Mr Arnab Hazra	IIST Shibpur
45	Dr Arun Kumar Bhaduri	Indira Gandhi Centre for Atomic Research, Kalpakkam	Mr Rahul Kumar Agrawal	NIT Warangal, Telangana
46	Prof BG Fernandes	IIT Bombay	Ms Sravani Sanikomm	SRM University, AP
47	Prof PP Mujumdar	Indian Institute of Science, Bangalore	Mr R Kirthana	University College of Engineering, Osmania University, Hyderabad
48	Prof Radha Kant Padhi	Indian Institute of Science, Bangalore	Mr Rishin Agarwal	Indian Institute of Space Science and Technology, Trivandrum
49	Prof DN Singh	IIT Bombay	Ms Guda Harshini	University College of Engineering, Osmania University, Hyderabad
50	Prof BK Mishra	IIT Goa	Mr Rishit Das	NIT Rourkela
51	Prof BB Chaudhuri	Computer Vision & Pattern Recognition Unit, Indian Statistical Institute, Kolkata	Mr Purbayan Kar	Jalpaiguri Govt. Engineering College, West Bengal



S No	Name of Mentor	Institution/ Organisation of the Mentor	Name of Engineering Student	Institution of Student
52	Dr Chandrashekhar Rode	Chemical Engineering and Process Development, CSIR-National Chemical Laboratory, Dr Homi Bhabha Road, Pune	Ms Nandini Singh	BIT Mesra, Ranchi, Jharkhand
53	Dr Ram Kumar Singh	IIT Bombay	Ms Riya Tyagi	Graphic Era (Deemed to be) University, Bell Road Clement Town, Dehradun
54	Prof SK Pal	Indian Statistical Institute, Kolkata	Ms Namrata Chaudhuri	BITS Mesra, Ranchi, Jharkhand
55	Prof Amitabha Ghosh	Honorary Scientist of Indian National Science Academy, New Delhi and The National Academy of Sciences, India, Allahabad	Ms Nidhi Prasad	BIT Mesra, Ranchi, Jharkhand
56	Dr K G Narayankhedkaar	Former Professor and Dean (Planning), IIT Bombay, Former Director, VJTI, Mumbai	Mr Angad Singh Sena	Shri Gobind Singhji Institute of Engineering and Technology, Nanded
57	Dr Naresh Chandra Murmu	CSIR-Central Mechanical Engineering Research Institute, Durgapur	Mr Nilabro Saha	NIT, Durgapur
58	Prof LM Patnaik	National Institute of Advanced Studies, IISc Campus, Bangalore	Ms Sayani Das	BIT Mesra, Ranchi, Jharkhand
59	Prof Jayant Haritsa	Indian Institute of Science Bangalore	Ms Srija Chakraborty	IIT Delhi

INAE Expert Groups

INAE's activities include programmes on issues of technology policy and overall development for the benefit of society. The Academy promotes research projects, pilot studies, engineering education, fellowships, scholarships, awards, and other benefactions. Seminars/Workshops/ Round Tables are conducted on topics of current national importance. The actionable recommendations emanating from the deliberations are submitted to the concerned Department/ Government agencies to assist in formulation of national policies. In this direction, INAE has in the year 2020, instituted "INAE Expert Groups" to prepare Technology Roadmaps with Actionable Recommendations. The objective of INAE Expert Groups is to develop a comprehensive technology roadmap with actionable recommendations on selected engineering themes or domains to help the country (Government, funding agencies, educational institutions, research organizations, industry, and users) formulate a policy, strategy and/or roadmap for implementation. A total of four proposals for INAE Expert Groups have been approved so far.

The list of INAE Expert Groups approved in 2020 along with the status on the progress of the activities undertaken during the year are as under.

- Proposal on "**Industrial By-products (IBPs) for Sustainable Infrastructure Development**" by Prof. DN Singh for a total budget of Rs. 20 Lakhs and duration of 24 months. Rs 12 lakhs out of approved budget of Rs 20 lakhs were disbursed towards the implementation of the Expert Group on January 7, 2021.

- (b) Proposal on **“Infrastructure and Resource Requirements for Introduction of Automation and its Adoption in the Mineral Sector of India: A Stakeholder Engagement”** by Prof. Jayanta Bhattacharya, IIT Kharagpur for a total budget of Rs. 20 Lakhs and duration of 24 months. Rs 6.4 lakhs out of approved budget of Rs 20 lakhs were disbursed towards the implementation of the Expert Group on January 7, 2021.
- (c) Proposal on **“Green Hydrogen in the Indian Economy – Technology Outlook for the Energy Transition”** by Dr. Ashish Lele, Reliance Industries Limited for a total budget of Rs. 19.58 Lakhs and duration of 18 months.
- (d) Proposal on **“Accelerated Materials Discovery, Scale-up and Exploitation Strategy for Strategic Materials Needs of India”** by Dr. Biswajit Basu for a total budget of Rs. 15 Lakhs and duration of 12 months.

The progress on the activities of INAE Expert Groups is given below.

Expert Group Report on “Accelerated Materials Discovery, Scale-up and Exploitation Strategy for Strategic Materials Needs of India” by Dr. Biswajit Basu, FNAE

INAE sanctioned a project titled ‘Accelerated Materials Discovery, Scale-up and Exploitation Strategy for Strategic Materials Needs of India’, in September 2020 to be executed by an INAE Expert Group over a period of a year. The Principal Investigator of this project is Dr. Biswajit Basu, with Prof. K.A. Padmanabhan and Dr. S.V. Kamat as the other two members. The objective is to *“prepare technology roadmaps with actionable recommendations”* for the implementation of an Integrated Computational Materials Engineering (ICME) approach for the accelerated development of new materials. This is consistent with *the INAE 2020-25 vision statement, wherein it is stated that “INAE shall strive to help institutionalize the ICME/ MGI approach in our national materials development efforts”*.

Materials form a critical part of a nation’s progress touching all aspects of life and industry. Conventionally, the development of new materials is undertaken using an empirical trial and error approach, with typical timelines of 15-20 years. However, in the modern context, there is an imperative need to drastically reduce these timelines to something of the order of 5 years or less, especially for the Strategic Sectors of Defence, Space and Atomic Energy. This is likely to involve an integration of computational engineering, data sciences/AI, information science & technology, materials characterisation & database, and high throughput experiments. The current study and recommendations of this expert group is focussed on structural materials, with possible parallels drawn for other materials.

The proposed approach is to build a strategic roadmap focussing on a few identified industry challenges as use-case problems spanning structural/engineering materials for defence, power (advanced ultra-super-critical (AUSC) thermal power plants), automotive (light weighting) and bio-implant/medical devices. The framework & experience can be subsequently leveraged to translate the approach to requirements for other strategic and industry sectors.

Towards realizing the Project objectives, a working structure has been formulated with an Apex Committee overseeing the activities. The ‘use-case problems’ have been classified into different workstreams, but within two broad groups, namely, Industry Challenge & Ecosystem. Each workstream is led independently by an “Anchor Expert”, who is supported by contributory experts (for active participation) & consulting experts, and the experts will identify critical gaps in technology, infrastructure, and ecosystem. The experts have been chosen to represent industry, R&D institutions, and academia. The anchor experts for all the workstreams are in place. The process of identifying the various other experts is in progress. Each anchor expert is responsible for preparing a part of the final report for his workstream in close consultation with the Apex Committee. Finally, the recommendations from these diverse workstreams will be harmonized to provide a unified roadmap for addressing the challenge of accelerated materials engineering.



The activities of the project are under progress through regular discussion and review meetings. So far, four meetings have been held in October 2020, November 2020, January 2021, and March 2021. Various presentations were made for the different workstreams, and extensive discussions were held towards advancing the various activities that are necessary towards formulation of the report. The preliminary plan of each workstream has been prepared. A core working group has also been formed to facilitate the running of the Project and help formulate the final Report. Workshops are being planned to identify industry challenges and gaps in ICME ecosystem in the country. Two surveys are being conducted with specific focus on industry and academia to obtain up to date and deeper insights. Draft structure of the final report has been formulated, and timelines have been evolved to take the Project to its logical conclusion.

With this, the committee and its members are confident of delivering a report in time with a clear and actionable plan that can help launch the imperative transformative initiatives for this important and strategic field of materials.

Expert Group Report on “Industrial By-products (IBPs) for Sustainable Infrastructure Development” by Prof. D.N. Singh, FNAE

The project “Industrial By-products (IBPs) for Sustainable Infrastructure Development”, evolved through intensive deliberations and nation-wide consultations and intensive deliberations at the INAE Forum on Engineering Interventions for Disaster Mitigation was approved in May 2020, at a time when the entire country was under a strict lockdown. As the first major step, an Expert Group was constituted by the Principal Investigator and much of the progress reported herein has been made so far by following the ‘social distancing norms’, connecting with the hand-picked experts, researchers and experts of multi-faceted expertise through the virtual mode. The focus IBPs were identified through a questionnaire widely circulated to over one hundred national & international researchers, and industry professionals netting several expressions of interest to participate. The next logical step was then to carry forward interactive discussion with the Industry Leaders via the WebEx platform. More than forty participants joined the discussion and shared their views & insights about the IBPs and issues connected to their handling, storage, and overall management. A follow-up questionnaire was circulated to seek their inputs and about a dozen responses were received. The process of consultation was widened in the same month (May 2020) to include faculty members and researchers, especially from the Department of Humanities & Centre for Policy Studies, IIT Bombay. The above effort led to the identification of the following IBPs and the establishment of the related Work Groups and Teams:

- i. Bauxite Residue (viz., red mud)
- ii. Slags (viz., copper, steel)
- iii. Dredged sediments
- iv. Construction and Demolition waste
- v. Overburden from mining
- vi. Mine tailings
- vii. Coal washery residues
- viii. Agricultural waste
- ix. Bio-mined waste
- x. Ash from combustion.

The Team Members were identified based upon research areas of mutual interest and willingness of experts to contribute against location and time constraints. The periodic consultations with the team members continued from November 2020 to January 2021 to arrive at a well-considered approach to advance the study. The slags and red mud modules were selected as the modules to begin with for the Mission IBPs, which connotes to the *Waste to Wealth to Welfare (WWW) mission*, series. To ensure the care of detail and objectivity, the responses for the slags module, received from the respective team, were subject to independent peer reviews and checks involving industry and academic experts for final review in March 2021. The project work is in progress and the final report after incorporating the reviewer's remarks will be presented to INAE by the June-July timeframe.

Participation from the Fellowship of INAE to make Mission IBPs successful is solicited. To join the mission, please write to:

missionibpiitbombay@gmail.com and dns@civil.iitb.ac.in

Expert Group Report on “Infrastructure and Resource Requirements for Introduction of Automation in the Mineral Sector of India: A Stakeholder Engagement” by Prof. Jayanta Bhattacharyya, FNAE

In view of COVID pandemic situation, the project work could not be progressed. However, the work accomplished so far is as under.

- Employment of temporary staff has been done and ongoing.
- Visits and discussion with some of the stake holders have been started.
- A questionnaire has been prepared to understand and collect the opinions of the two stakeholder groups: academia and the industry. By discussions, the Questionnaire for the academia has been completed and frozen. In almost all cases, the questionnaire needs a discussion with the academic stakeholders for their appropriate response. COVID-19 and the lockdown has put a stop on this activity. The Questionnaire for the Industry is under preparation.
- An online discussion with the user industry was organized but had to be postponed because of the recent lockdowns from the first week of May 2021 till the end of May 2022

INAE Expert Group on “Green Hydrogen in the Indian Economy – Technology Outlook for the Energy Transition”

One of the proposals for INAE Expert Group on “Green Hydrogen in the Indian Economy – Technology Outlook for the Energy Transition” by Dr. Ashish Lele, Reliance Industries Limited was approved by the INAE Governing Council by circulation, in view of the Governing Council meeting scheduled on March 6, 2020, being called off due to the COVID -19 Pandemic. The objectives of this Expert Group are given below:

- To evaluate the cost of green hydrogen production at scale using variable renewable energy (VRE) resources in India.
- To assess the techno-economic feasibility of substituting existing fuel/feedstock with green hydrogen in hard-to-decarbonise industries like ammonia, iron and steel etc.
- To assess the economic impact of using hydrogen as a storage medium to provide dispatchable power and increase grid reliability.
- To estimate the decarbonisation potential of using renewable hydrogen in industrial sector.

Some co-benefits and broader goals that are expected to deliver on from this assessment are:

- Identifying potential barriers and market failures that could help develop policy measures to accelerate the development of the hydrogen economy.
- We also propose an evaluation of economic benefits (or losses) in terms of employment, economic value addition and investment requirements stemming out from the transition to the hydrogen as a preferred fuel in specific applications.
- Finally, the study will have actionable recommendations for suitable policy and regulatory framework to encourage private investments in supporting the transition to the green hydrogen economy.

The scope of the Expert Group is given below:

- The study will assess the economics and carbon mitigation potential of the entire value chain starting from production, storage, transport and final consumption within the end-use applications – industry and energy storage.
- The study will map the existing hydrogen value chain and compare its process economics and carbon emissions with green hydrogen production technologies.
- While the geographic focus will be across the Indian landmass, special attention would be given to industrialised states and those having a high renewable energy potential.

The relevance to Indian scenario of the Expert Group is as follows:

- Strengthen the National Hydrogen Energy Roadmap (MNRE 2006) launched by Government of India through showcasing the potential of industrial sector in spearheading the transition to a hydrogen economy. At a time when RE based electricity generation has become significantly cheaper and there are concerns of curtailment and need for balancing technologies by way of storage (mostly electrochemical, as envisioned today), the production of hydrogen presents a unique opportunity.
- Provide research directions and enable setting-up technology development targets for Government initiatives like Energy Storage Platform on Hydrogen (DST; IITB 2019) , Centre for Materials and Energy Storage Platforms – H₂ (DST; NFTDC 2019), and Hydrogen Association of India (HAI 2019). The analysis would also provide a starting point for assessing the viability of transitions like CNG to hydrogen enriched CNG (HCNG) (NITI Aayog 2019).
- Supporting the indigenous electrolyser technologies (created under the roadmap) achieve full-scale commercial deployment and incentivising R&D efforts to develop indigenous technologies for hydrogen storage and transport mechanisms.
- Assessing the overall decarbonisation potential that hydrogen provides for the economy as a whole, the environmental benefits – climate change and co-benefits of such a transition to hydrogen.
- Bolster international collaborative partnerships on climate change like – India and Sweden leadership programme on Industrial decarbonisation (PIB 2019).

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 have been constituted – INAE Forum on Energy, INAE Forum on Technology, Foresight and Management, INAE Forum on Engineering Interventions for Disaster Mitigation, INAE Forum on Indian Landscape of Advanced Structural Materials and INAE Forum on Civil Infrastructure. These forums enable giving inputs to policy makers, institutes of higher learning & research, industries, etc.

INAE Forum on “Civil Infrastructure”

The forum was formed to address the subject area of INFRASTRUCTURE, to cover specifically the issues of Traffic & Transportation, Housing and Water. The main objective of the forum is to create reports from its study to recommend needed actions, related to, Policy Initiatives, Engineering Development/Research, Education, and, so on, and, suggesting the Way Forward. To begin with the area of Traffic & Transportation was addressed. A report entitled, “URBAN TRANSPORTATION: Challenges and Way Forward” based on the study, was released at the Annual Convention of the INAE at Jaipur in December 2019.

Further, as per the mandate of the Forum a study has been undertaken to address the subject of Housing. For this purpose, the membership of the Forum was reorganised such that it is more sharply focussed on the subject area of Housing, and, now consists of, Prof. Prem Krishna, Prof Mahesh C. Tandon, Prof P. K. Sikdar, Dr. Mangu Singh, Prof. N. Raghavan, Dr. S. K. Bhattacharyya, and, Prof. Satish Chandra, Director CRRI, Dr. S. K. Agarwal, Executive Director, BMTPC, Mr. K. Senou, Head Precast Initiatives, L&T, and, Mr. Sanjay Pant, Director Civil Engineering, Bureau of Indian Standards. The Forum has so far had ten meetings and there is good understanding of issues and their dimensions. Although the report was expected to be completed by June/July 2020, COVID-19 has cast its shadow on this exercise too. However, the report of the study has entered its pre-final stage.

In studying this problem, the focus has been the housing shortage and its alleviation both in the urban as well as rural context. It was decided to first make a comprehensive study of the problem involving not only the engineering issues, but also other related ones such as, policy interventions needed. The assessment of gap between demand and availability of housing in the country as well as in various states has been brought out. Also, for this purpose, the various initiatives taken by the Government of India to overcome shortage of housing in the country, have been studied.

It is noteworthy that ever since the Country attained independence, there has been continuous effort to a larger or a smaller degree by the Government to address the problem of Housing shortage. This has been in addition to efforts by general public to cater for housing for themselves. In the last 2 – 3 decades, the private sector has also taken initiatives to construct housing colonies. Currently the gap runs into tens of millions in both rural as well as urban housing. Some of it will be filled by individual investment, but a large proportion will require Public Sector inputs in terms of policy and planning, as well as investment. Furthermore, at least in the urban context, the concept of mass industrialised housing needs to be adopted. This may even be so, in the semi – urban as well as the rural context if the size of the project is large enough.

The mission launched by the Government in 2017 to provide housing for all by 2022, has brought great impetus for the housing sector. There has been multi-pronged approach and a laudable effort in the last couple of years has enabled the identification of a set of technologies for this purpose. Effort is also on to gain a deeper working



understanding of some of these technologies by deploying them in what is being described as “Lighthouse Projects”. Most of this effort is still in a nascent stage, except the technologies based on precast concrete construction, for which a reasonable degree of experience does already exist.

The study in hand has made a critical analysis of the scenario and the ongoing efforts, in order to be able to contribute by recommending possible improvements in technologies being used, related engineering issues, as well as any policy interventions that could prove to be useful to the housing industry. Although the time remaining between the completion of this report and the 2022 deadline is limited, the study should be expected to add value to the ongoing effort for achieving the target. In any event, the report brings out further new ideas for it to be useful in the years to come for fulfilling the additional national needs related to housing, in the coming years.

The report consists of Chapters entitled, *Introduction, Housing Scenario in India, Concepts and Technologies for Housing, Industrialised Building Systems, Review of Emerging Construction Systems, Enablers and Policy Interventions Required for Implementation of Emerging Technologies, Standardisation, Recommendations & Way Forward, besides being accompanied by an Executive Summary.*

INAE Forum on “Engineering Interventions for Disaster Mitigation”

The Forum focused its attention on four areas of emerging national importance (1) Initiate debate and possibly a project on the multi-faceted aspects of Valorization of Industrial Wastes for Hazard Mitigation for sustainable development for funding by INAE (2) debate the flagship initiatives of the Government in the area of disaster risk resilience from multi-hazard perspective and continue making contributions as per the evolving opportunities and invitations (3) take proactive initiatives towards writing professional papers in the field of Forum’s expertise and (4) Ensure that all the recommendations made by the Forum from time to time are effectively followed for adoption and implementation. The progress in these four areas is reported below seriatim:

1. INAE had approved the project proposal in May 2020 to be implemented by Prof DN Singh, a member of the Forum, as the Principal Investigator. This is a unique initiative that aims to address the issues of sustainable management of a range of IBPs through a collaborative effort between various stakeholders such as industry, academia, researchers and the policymakers. The Principal Investigator has reported on the progress made so far through a separate note.
2. Interactive discussion on flagship national initiatives is a regular item of the Forum’s Agenda. Overall progress during the period under report was discussed at the meeting held on 20 December 2020 with reference to the (a) Consortium for Disaster Resilient Infrastructure (CDRI) launched by the PM at the UN Climate Summit (b) Disaster Mitigation Fund and the Report of XV Finance Commission (c) First Jai Krishna Memorial Oration and (d) Recent IRC Documents related to Disaster Mitigation. The landmark decision of establishing DMF is a matter of great satisfaction for the Forum especially because of its pro-active initiative to submit a paper on DMF which was presented at the NDMA’s National Advisory Committee. INAE Forum may consider taking pro-active initiative to connect with CDRI to shape Forum’s agenda. INAE Forum may also consider benefitting from the CDRI Fellowship Programme. It is a matter of great satisfaction that Forum members Dr Prem Krishna and Dr R.K. Bhandari were both special invitees and speakers at the launch of the first Dr Jai Krishna Memorial Oration on 6 November 2020 at IIT Roorkee, in honour of INAE’s founder President.
3. Every member of the Forum discussed ideas that need to be persuaded. Forum member, Prof SS Chakraborty, has developed a discussion paper on Sustainable and Resilient Infrastructure including urban development and transport. Professor S.K. Thakkar has developed a first order paper on Lessons from Earthquakes for disaster resilience.

4. Forum has the utmost satisfaction that most of its Recommendations have not only received overwhelming support but are at different stages of Implementation. These were recognized by the Journal of Current Science which sought a Second Guest Editorial from the Forum Chairman, currently under print. The first Guest Editorial was published in 2013 and the contribution has been particularly mentioned in the citation for the Subhash Chandra Bose “Apada Prabandhan Puruskar 2020” awarded to the Forum Chairman.

INAE Forum on “Energy”

The Energy Forum considered the possibilities of the role of engineering and technology during the current pandemic and post-pandemic period. A need was felt to discuss and synthesise on following two issues and present our findings to the Fellowship and concerned government departments:

- a. Energy for Accelerated Growth of Renewable Energy Application in India.
- b. Development of Breakthrough Technologies for Indian Energy Sector.

A Webinar on ‘Energy for Accelerated Growth of Renewable Energy Application in India’ was organised on 25 July 2020. Dr Sanak Mishra, President, INAE welcomed the guests. The Panel consisted of Dr. Ajay Mathur, DG, TERI; Mr Sumant Sinha, MD, ReNew Power; Mr K.S. Popli, Former CMD, IREDA; and Dr B. Bandyopadhyay; Dr. P.C.Maithani, Former Director, Solar Energy Centre. Mr Pradeep Chaturvedi coordinated the discussion.

The outcome was circulated in INAE Newsletter to all Fellowship. The full Report and outcome were also forwarded to MNRE.

The Webinar on Development of Breakthrough Technologies for Indian Energy Sector was planned but had to be postponed due to worsening pandemic conditions and will be organised during the next year.

Dr Ajay Mathur attended CAETS 2020 and associated CAETS Energy Committee Meeting in October 2020.

Mr. Pradeep Chaturvedi attended the First CAETS 2022 Energy Committee Meeting on 19 February 2021. The Committee decided to conduct a Study to be released at the time of the CAETS. Mr Chaturvedi was a Member of the Core Group that prepared the Scoping Paper by March 2021. In a subsequent meeting a presentation was made on ‘Towards Decarbonising the Building Sector: Focus on Sustainable Cooling Strategies’ jointly by Dr Bandyopadhyay and Mr Chaturvedi. The contents were accepted, and a detailed presentation is planned for a future date that will make it a part of the Global reports. Chairman and Members of CAETS Energy Committee appreciated the involvement of INAE.

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 2012 under the Chairmanship of Mr. V.K. Agarwal, Formerly Chairman Railway Board & Ex-officio Principal Secretary to Govt. of India & Formerly Director Steel Authority of India and Indian Oil Corporation with Dr. Y.P. Anand, Formerly Chairman Railway Board & Ex-Officio Principal Secretary, Govt. of India; Prof. Prem Vrat, Vice-Chancellor and Professor of Eminence, ITM University, Gurgaon & Formerly Vice-Chancellor UP Technical University; Dr. C.R. Prasad, CMD, Everest Power Pvt. Ltd., New Delhi & Formerly CMD, GAIL; Mr. Anil Kumar Anand, Director Technical, Microtrol Sterilisation Services, Mumbai & Formerly Director (Reactor Projects Group), BARC; Mr. Pradeep Chaturvedi, Vice President, World Environment Foundation & Formerly Regional Representative, Centre for Application of Solar Energy, UNIDO (joined later); Mr. Kishore Pal Singh, Formerly Managing Director RITES and Managing Director, Tata Projects Ltd.; Mr. Suresh Chandra Gupta, Formerly Member Electrical, Railway Board & Ex-officio Secretary to Govt of India; Mr. Vinoo Narain Mathur, Formerly Member Traffic Railway Board & Ex-



Officio Secretary to Govt. of India; and Mr. Arun Kumar Gupta, Formerly Director Oil India Ltd. and Editor, RITES Journal as the Members of the Forum. In order to cover the wide spectrum of the pertinent issues, Shri Keshav Chandra, Former Member Mechanical Railway Board & Ex-Officio Secretary to the Govt. of India and Shri A. P. Mishra, Former Member Engineering Railway Board and Ex-Officio Secretary to the Govt. of India were recently included as Members of the Forum especially with a view to cover the emerging challenges and to strengthen the Forum for handling the current issue of 'Boost to Rail in MSME Sector'.

The mandate of the Forum is to evolve solutions keeping in view the issues of sustainable development, poverty reduction, and climate change in focus and suggest appropriate technologies accordingly. Further, suitable Engineering Management techniques will be employed to find cost effective and optimal solutions. Domain of National Challenges is very wide and also keeps on changing from time to time. This Forum would selectively address the following mentioned domains as a broad guide (a) Food Production and Utilisation and Conservation of Water (b) Energy Generation and Utilities (c) Manufacturing Technologies (d) Mass Transit Systems and (e) Building and Construction Technologies.

The First Report of the Forum was published in 2014 which covered the areas pertaining to Waste Management, Water – Meeting the Future Challenges, and Transport – Making it Greener. The Second Report of the Forum was published during 2016 which covered the aspects of Agriculture – Waste Reduction and its use; Energy – Major Thrust on Solar; and Mass Transit Systems. The Third Report of the Forum was published in 2018 which addressed pertinent issues and concerns regarding Rural Urban Continuum and Development of High-Speed Rail in the country.

After the release of three reports, the Forum brought out the Fourth Report covering three broad areas viz. (a) Issues of Environment / Climate Change / Sustainability (b) Rail-based Infrastructure Urgently Needs Four Major Interventions at the Level of Government of India (c) Improving the Operating Ratio of Indian Railways – A Way Forward. The Fourth Report of the Forum was published in November 2020.

The Forum is currently examining the following (Five Areas):

1. "Logistics"
2. "Municipal Solid Waste Management"
3. "Energy Sector with special reference to Solar and Coal Power"
4. "Engineering Focus for Future Development in India"
5. "Boost to Rail in MSME Sector"

The Institution of Engineers India who were celebrating their Centenary in December 2020 requested the Chairman for a Technical Monograph on some New Area and also a Lead Article in the Centenary Book being prepared by collecting articles regarding "Future of Engineering". Since both were connected with futuristic areas and Technology Foresight Forum, Chairman consented. A Technical Monograph titled "Survival of Planet Earth: Scientifico-spiritual Analysis" and an article among the 33 contributed by eminent engineers titled "Role of Engineers in Policy Making" were made. Group members are also going through these details so that they get food for thought for the Five Areas currently under examination.

INAE “Satish Dhawan Chair(s) of Engineering Eminence”

INAE Satish Dhawan Chair of Engineering Eminence was instituted with the objective of enhancing the visibility of the Academy in the policy domain and establishing social connect. Eminent engineers who have contributed to some aspect of nation building are chosen for this esteemed position. The objective of the Chair is to utilize their competence to facilitate future growth of the nation in the engineering domain. The INAE Governing Council had recommended Dr. BN Suresh, Former President of INAE; Chancellor, Indian Institute of Space Science & Technology (IIST) and Honorary Distinguished Professor, ISRO Headquarters, Bangalore and Formerly Director, Vikram Sarabhai Space Centre, Trivandrum; and Formerly Member, Space Commission and Founder Director, Indian Institute of Space Science & Technology (IIST), Thiruvanthapuram for holding Satish Dhawan Chair of Engineering Eminence for the year 2021, extendable up to one more year. He is associated with ISRO HQ for Institutional support for carrying out the work under the aegis of the Chair. Dr BN Suresh has chosen the topic of “Contribution of Space for National Development and the Possible Future Areas to improve the Indian Economy”, to work under the ambit of this Chair. The task will be to consolidate the utilisation of space technology-based tools so far in Governance and national development, which has made significant contributions in several areas of agriculture, energy, environment, forestry, water resources, communication and navigation, health, education, disaster management and many other areas. Further the report will include the possible areas of new applications of space for accelerating the national development thus contributing to the growth of the National Economy.

Engineering Excellence Awards

Life Time Contribution Award in Engineering 2020

This award is given to an eminent Indian citizen who has made most distinguished contributions in the field of Engineering / Engineering Research / Technology, which have brought prestige to the nation and regarded as landmarks of technological development of the country.

During the year 2020, the Life Time Contribution Award in Engineering was conferred on:



Prof. K.A. Padmanabhan, Professor of Eminence, Department of Mechanical Engineering, Anna University, Chennai and former Director, IIT Kanpur was conferred the award virtually in recognition of his outstanding contributions to the growth of Engineering Education in the country as an institution builder and pioneering research in Materials Engineering



Dr. TSR Prasada Rao, Formerly Director, IIP, Dehradun was conferred the award virtually in recognition of his outstanding contributions in developing indigenous mission - critical technologies and transforming of Indian Institute of Petroleum as a world-class innovation centre.

Prof. Jai Krishna and Prof. SN Mitra Memorial Award 2020

These awards are given to an eminent engineer, engineer-scientist, or a technologist for one or more of the following:

- (a) Academic and scholarly achievements in any discipline of technology
- (b) Outstanding research in engineering and technology and application thereof.
- (c) Outstanding contributions in the management of education and research in engineering
- (d) Outstanding achievements and contributions in the Indian industry, engineering services or engineering projects

Prof. Jai Krishna Memorial Award is given from among the disciplines of Engineering Section I (Civil Engineering), Engineering Section III (Mechanical Engineering), Engineering Section IV (Chemical Engineering), Engineering Section VII (Aerospace Engineering) and Engineering Section VIII (Mining, Metallurgical and Materials Engineering).

Prof. S. N. Mitra Memorial Award is given from among the disciplines of Engineering Section II (Computer Engineering and Information Technology), Engineering Section V (Electrical Engineering), Engineering Section VI (Electronics & Communication Engineering), Engineering Section IX (Energy Engineering) and Engineering Section X (Interdisciplinary and Special Engineering Fields and Leadership in Academia, R&D and Industry)

During the year 2020, Prof Jai Krishna and Professor SN Mitral Memorial Awards were conferred on:

Prof Jai Krishna Memorial Awardee



Dr V Ramaswamy, Professor, Department of Metallurgical Engineering, PSG College of Technology, Coimbatore was conferred virtually the Prof Jai Krishna Memorial Award 2020 in recognition of his outstanding research contributions in the field of Ferrous Metallurgy for applications to Indian Railways and strategic sectors, such as Atomic Energy and Defence.

Professor SN Mitra Memorial Awardee



Prof LM Patnaik, INSA Honorary Scientist and Adjunct Professor, National Institute of Advanced Studies, Bangalore and formerly Vice-Chancellor, Defence Institute of Advanced Technology (DIAT), Pune was conferred virtually the Prof SN Mitra Memorial Award 2020 in recognition of his outstanding research contributions in the field of Computer Science for applications in strategic areas, such as Satellite Technology and Nuclear Reactors.

INAE Outstanding Teachers Award 2020

The Academy has instituted the “Outstanding Engineering Teachers Award” in the year 2013 to honour INAE Fellows who have excelled in the field of teaching in Indian colleges, universities, and institutions, and have provided guidance and inspired students to take up careers in Engineering and Technology. Two such awards are given per year with one award in each group as under.

Group-1 - covering Engineering Section I (Civil Engineering), Engineering Section III (Mechanical Engineering), Engineering Section IV (Chemical Engineering), Engineering Section VII (Aerospace Engineering) and Engineering Section VIII (Mining, Metallurgical and Materials Engineering).

Group-2 - covering Engineering Section II (Computer Engineering and Information Technology), Engineering Section V (Electrical Engineering), Engineering Section VI (Electronics & Communication Engineering), Engineering Section IX (Energy Engineering) and Engineering Section X (Interdisciplinary and Special Engineering Fields and Leadership in Academia, R&D and Industry).

During the year 2020, INAE Outstanding Teachers Award was conferred on:



Prof. Ranjit Kumar Ray, AICTE-INAE Distinguished Visiting Professor; and Formerly Head, Advance Centre for Materials Science, Department of Materials and Metallurgical Engineering, IIT, Kanpur was conferred the Outstanding Teachers Award virtually in recognition of his outstanding contributions to teaching and research in the area of Materials and Metallurgical Engineering and for mentoring students in innovation and research activities.



Prof Bhim Singh, CEA Chair Professor, Department of Electrical Engineering, Indian Institute of Technology Delhi was conferred the Outstanding Teachers Award virtually in recognition of his outstanding contributions in innovative teaching, research, development and consulting and for inspiring students to develop creative and communication skills and carry out novel research activities.

INAE Woman Engineer of the Year Award 2020

Indian National Academy of Engineering (INAE) has instituted “INAE Woman Engineer of the Year Award” from the year i.e. 2020 onwards with the aims to recognize meritorious and original contributions made by woman engineers in India from academia, research organizations or industry, whose individual efforts have made a significant difference in any branch of engineering and technology, by way of breakthrough innovation and disruptive change in different fields of engineering and have helped to advance the knowledge and competence to the benefit of the profession and people in India. Three such awards are given, one each in three categories, (i) Academia, (ii) Industry and (iii) R&D. Woman engineers between the age of 40 to 60 years, who should be a citizen of India and working in India are eligible for nomination.

The recipients of INAE Woman Engineer of the Year Award 2020 under three categories, (i) Academia, (ii) Industry and (iii) R&D are as under:

1. **Academia** - Prof Sanghamitra Bandyopadhyay, Indian Statistical Institute, Kolkata.
2. **R&D** - Dr Lalithambika VR, Directorate of Human Space Programme, ISRO
3. **Industry** - Dr Dheepa Srinivasan, Pratt and Whitney, R&D Centre United Technologies Corporation India Pvt. Ltd, Bangalore

INAE Young Entrepreneur Award 2020

INAE Young Entrepreneur Award was instituted in the year 2017 to encourage and recognize innovation and entrepreneurship among Young Engineers. The engineering innovations/inventions/ concepts that have been actually realized and implemented in industry either in new processes or products are given weightage.

The recipients of the award for the year 2020 are:

- 1 Mr. Akshay V. Singhal, CEO & Founder, Log 9 Materials Scientific Private Ltd., Bengaluru.
- 2 Dr. Anuya A. Nisal, Principal Scientist, CSIR-National Chemical Laboratory, Pune.

Besides this, two Special Commendation were given as under.

- 1 Dr. Sundararajan Krishnan, Founder and CEO, Aptener Mechatronics Private Limited, Bengaluru
- 2 Mr. Jayant Sitaram Karve, Founding Director and CEO, RCupe Life sciences Pvt Ltd, Bengaluru

INAE Young Engineer Awards 2020

The Academy instituted INAE Young Engineer Awards in 1996, to recognize excellence in design and technology transfer, innovative development, and engineering research. The scheme has attracted nominations of bright young talent in the country and has become a prestigious national award since then. So far, 258 young engineers have been conferred this award and their early recognition has encouraged the best upcoming talent to make innovative engineering and technological contributions for our national development. The nominations for INAE Young Engineer Award for the year 2020 were sought from INAE Fellowship, Engineering institutions, R&D Labs. Out

of 134 nominations, 33 were shortlisted by the Sectional Committees. The shortlisted candidates gave virtual presentation of their work before the Selection Committee on August 20, 2020.

The following fifteen candidates were selected and conferred INAE Young Engineer Award 2020.

- 1 Dr. N M Anoop Krishnan, Indian Institute of Technology Delhi
(*Physics and data-based modeling of materials*)
- 2 Dr. Swatantra Pratap Singh, Indian Institute of Technology Bombay
(*Environmental Engineering*)
- 3 Dr. Pawan Goyal, Indian Institute of Technology Kharagpur
(*Natural Language Processing*)
- 4 Dr. Neeldhara Misra, Indian Institute of Technology Gandhinagar
(*Theoretical Computer Science; Algorithm Design*)
- 5 Dr. Prosenjit Das, CSIR-Central Mechanical Engineering Research Institute, Durgapur
(*Materials processing and Manufacturing*)
- 6 Dr. Ravi Kumar Arun, Indian Institute of Technology Jammu
(*Microfluidics, Lab on Chip Devices, Energy Conversion and Storage*)
- 7 Dr. Rahul Mangal, Indian Institute of Technology Kanpur
(*Polymer Physics, Soft Matter, Rheology*)
- 8 Dr. Swaroop Subhash Gajare, Eaton India Innovation Center Pune
(*Power Systems*)
- 9 Dr. Sumit Kumar Pramanick, Indian Institute of Technology Delhi
(*Power Electronics and Drives*)
- 10 Dr. Digbijoy N Nath, Indian Institute of Science, Bangalore
(*Semiconductor devices & heterostructures, gallium nitride based high electron mobility transistors (HEMTs)*)
- 11 Dr. Raghvendra Kumar Chaudhary, Indian Institute of Technology (Indian School of Mines), Dhanbad
(*RF & Microwave Engineering*)
- 12 Dr. Pooja Devi, Central Scientific Instruments Organisation, Chandigarh
(*Materials Engineering, Sensors, Water & Energy Harvesting Devices*)
- 13 Dr. Mudrika Khandelwal, Indian Institute of Technology Hyderabad
(*Nanofibrous Composites*)
- 14 Dr. M Sathish, CSIR-Central Leather Research Institute, Chennai
(*Leather Technology*)
- 15 Dr. D Josephine Selvarani Ruth, Indian Institute of Science, Bangalore
(*Instrumentation and Control Engineering*)

Innovative Student Projects Awards 2020

The Academy has instituted Innovative Students Projects Award since 1998 to identify innovative and creative projects undertaken by the students at three levels B.E./ B. Tech, M.E./ M.Tech and PhD in engineering colleges. This Award recognizes innovative and creative projects and theses of students and research scholars in engineering institutions, since an early recognition of merit and talent can often mark the beginning of a brilliant career.

In view of unprecedented crisis due to impact of COVID-19 and irregularity in the academic session at all education levels; the criteria for accepting the nominations for INAE Innovative Student Projects Award for the year 2020 was revised as a special case and the last date of the receipt of Nominations for Innovative Student Projects Award 2020 was also extended from 7th July 2020 to August 31, 2020.

The first meeting of the Selection Committee was held virtually on September 11, 2020 to initially shortlist the nominees and subsequently the shortlisted candidates made presentation of the thesis work done before the Selection



Committee during its meeting held on September 29, 2020. The list of recipients of Innovative Student Projects Awards 2020 is given below.

Doctoral Level

- 1 Dr. Stefie J. Stephen, Indian Institute of Technology Madras
(Incorporation of time-dependent fracture behaviour in the structural design of fibre reinforced concrete elements)
- 2 Dr. Asha Das, Cochin University of Science and Technology, Kerala
(Automated Nuclear Pleomorphism Scoring in Histopathological Breast Cancer Images)
- 3 Dr. Kuppuraj Rajamanickam, Indian Institute of Science Bangalore
(Studies on Flow Dynamics and spray swirl Interactions in Gas Turbine Combustor)
- 4 Dr. Akshay Modi, Indian Institute of Technology Bombay
(Tailored Polymer Nanocomposite Hollow Fiber Membranes for Biomedical, Gas Separation and Water Treatment Applications)
- 5 Dr. Priyank Mukeshkumar Shah, Indian Institute of Technology Delhi
(Adaptive Control Strategies for Resilient Operation of Grid Interfaced Solar Energy Conversion System Enabling Power Quality Improvement)
- 6 Dr. Sayan Dey, Indian Institute of Technology Kharagpur
(NiO Based Sensors for VOC and Heavy Metal ion detection)
- 7 Dr. Chandan Bose, Indian Institute of Technology Madras
(Dynamical Analysis of unsteady flow phenomena around Flapping wings)
- 8 Dr. Jhansi Jadav, University of Hyderabad, School of Engineering Sciences & Technology, Hyderabad
(Assessment of Precipitation, deformation and fracture behaviour of Superni 263 Ni base Superalloy under Tensile and Low cycle fatigue conditions)
- 9 Dr. Debanjan Das, Indian Institute of Science Bangalore
(New avenues to transition metal-based water splitting electrocatalysts)
- 10 Dr. Souvik Ghosh, Indian Institute of Science, Bangalore
(Optical and opto-thermal route towards dynamic nanomanipulation in fluids)

Master's Level

1. Joint Award

- (i) Mr. Sarosh Alam Ghausi, Indian Institute of Technology Bombay
(Sensitivity of Precipitation and Streamflow Extremes to Temperature over Central and South Asia)
- (ii) Mr. Suman Banerjee, Indian Institute of Technology Madras
(Incorporating Domain Knowledge In Multilingual, Goal-Oriented Neural Dialog Models)

2. Joint Award

- (i) Mr. Adarsh Somayaji, Indian Institute of Technology Madras
(Design & Analysis of a Variable Stiffness Adaptive Jaw for Robust Grasping)
- (ii) Ms. Krishna Manoj, Indian Institute of Technology Madras
(Emergence of Rich Dynamical Behaviour in Networks of Coupled Candle-Flame Oscillators: Synchronization, Amplitude Death, and Chimeras)

3. Joint Award

- (i) Ms. Thakur Smruti Mahendra Madhavi, Institute of Chemical Technology Mumbai
(Ultrasound assisted catalytic transfer hydrogenation of corn oil using Pd/C catalyst by formaldehyde reduction method)
- (ii) Mr. Pravin Kumar, Indian Institute of Space Science and Technology Thiruvananthapuram
(Effect of Process Parameters on the Microstructures, Defects, and Mechanical properties in 3D-Printed (SLM/PBF) Inconel 718 alloy)

4. Joint Award

- (i) Mr. Malepati Venkata Sai Krishna, National Institute of Technology Calicut
(Development of Active Switched Impedance Network Based NON- Isolated DC-DC Converters)
- (ii) Mr. Vinay Chandrasekhar K, International Institute of Information Technology Bangalore
(Design, fabrication, and analysis of a portable anthropomorphic upperlimb rehabilitation and exoskeleton system)
5. Ms. Anukiruthika T, Indian Institute of Food Processing Technology (IIFPT)
(Design and Fabrication of Customized Foods Using 3D Printing)

Bachelor's Level

- 1 Mr. Rishav Dutta, Indian Institute of Engineering Science and Technology (IIST), Shibpur
(Prediction of Stochastic Non-Stationary Downbursts and Hurricane Wind Field)
- 2 Ms. Gayathri Girish, Indian Institute of Space Science and Technology, Thiruvananthapuram
(Utilizing Energy Function and Variational Inference Training for Designing a Novel Graph Neural Network Architecture)

3 Joint Award

- (i) Mr. Rayudu Rahul, National Institute of Technology Raipur
(Internal Linear Mechanism Device for Vertical Transport Distraction Osteogenesis of Maxillo Mandibular Reconstruction)
- (ii) Mr. Aakash, Indian Institute of Technology Tirupati
(An Analytic study of the Wiedemann-Franz Law and the thermoelectric figure of merit)
- 4 Mr. Alok Kumar Pandey, Indian Institute of Technology Hyderabad
(Pencil Lead based Graphite-Silica Composite Anodes for Practical Lithium-ion Batteries)
- 5 Mr. A Sai Darahas, Mr. R. Raghavendra, Ms. K. Vineetha and Mr. Y. Nanda Kishore
National Institute of Technology (NIT) Andhra Pradesh
(3D Multispectral Brain Tumour Segmentation Using Deep Neural Networks)
- 6 Mr. British Sontakke, Indian Institute of Space Science and Technology, Thiruvananthapuram
(Magnetic Transduction Schemes and Electronics for Angular Position Sensing of Through-Shafts over Full Circle Range)
- 7 Mr. Allam Varshith Reddy, Indian Institute of Space Science and Technology, Thiruvananthapuram
(Iterative Patched Conic Technique for Lunar Transfer Trajectories)
- 8 Mr. Arvind Pujari, Indian Institute of Technology Madras
(Al-based Plasmonic Nanoparticles as an Alternative to Noble Metal Plasmonics)
- 9 Ms. Siri Gadipudi, Indian Institute of Space Science and Technology Thiruvananthapuram
(Grid Connected Open-end Winding Induction Generator System with Series Reactive Power Compensation for Wind Energy Systems)

10 Joint Award

- (i) Mr. Amogh B S, Birla Institute of Technology and Science, Pilani
(Black Phosphorous based sensors for healthcare applications)
- (ii) Mr. Khushank Singhal and Mr. Sumakesh Mishra
Indian Institute of Technology Delhi
(Development of Fast and Efficient Air Purification System)

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 is popular among industry experts as well as engineering colleges.

Due to sudden outbreak of the Covid pandemic, the scheme was temporarily put on hold for a period of April 2020 –November 2020. A modified Standard Operating Procedure (SOP) was proposed for allowing existing DVPs conduct online classes and sent to AICTE for approval. The MoU was due for renewal in 2020 and was signed on November 11, 2020, with effect from September 12, 2020. The modified SOP was accepted as a part of the MoU. AICTE requested INAE to resume the operation of the scheme w.e.f. February 2021.

The extension of tenure for the 40 existing which was due for the academic year 2020-21 was intimated after signing of the MoU so that they may conduct online classes in their associated colleges till Jun 30, 2021. As per practice, an annual meeting of AICTE-INAE Distinguished Visiting Professorship Scheme Committee was held on February 12, 2021 to select new DVPs from the nominations received from various AICTE approved colleges.

INAE received 53 fresh nominations of Industry / R&D experts under the scheme in response to advertisement published by AICTE for academic year 2021-22. The Committee reviewed and deliberated on all the nominations and 9 candidates were selected.

The names of Selected Industry/R&D Experts as given below:

1. Dr. Padmanabham Gadhe, FNAE, Director, International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI), Hyderabad.
2. Dr. R. Gopalan, FNAE, Regional Director, International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI), Chennai.
3. Dr. Satyanarayana Bheesette, Scientific Officer (H), TIFR, Mumbai, Coordinator, India-based Neutrino Observatory (INO) Project Visiting Professor, Dept. of Applied Science, American College, Madurai.
4. Dr. K. Gopa Kumara Warriar, Chief Scientist (Retired), CSIR-NIIST, Kerala; UGC Adjunct Faculty, Material Science, Kannur University, Kerala.
5. Dr. Bharat Bhanudas Kale, Scientist G / Director General (A) / Director (A), Centre For Materials for Electronics Technology (C-MET), Pune. Ministry of Electronics & Information Technology (MeitY).
6. Dr. K. C. Vora, Sr. Deputy Director & Head, Automotive Research Association of India (ARAI) Academy, Pune.
7. Dr. B. S. Sreenivas Consulting Engineer, ECONS

8. Dr. Hasan Sheikh Retired as Scientist H from IGCAR, Kalpakkam
9. Dr. N.S. Raman Former Deputy Director and Head Environment Audit, National Environmental Engineering Research Institute, Nagpur

Since the scheme is extended to retired INAE Fellows, applications were invited from INAE Fellowship. 12 applications were received from retired INAE Fellows which were discussed, and 7 applications were selected based on their age and institution chosen.

The names of Selected Retired INAE Fellows are as given below:

1. Dr. Rabindra Nath Ghosh, ES-VIII (Mining, Metallurgical and Materials Engineering)
2. Mr. Ajay Narayan Deshpande, ES-IV (Chemical Engineering)
3. Prof. Rajendra Prasad Chhabra, ES-IV (Chemical Engineering)
4. Dr. Ram Kumar Singh, ES-IX (Energy Engineering)
5. Prof. Malay Kumar Kundu, ES-II (Computer and Information Technology)
6. Dr. Debabrata Das, ES-IX (Energy Engineering)
7. Dr. C. V. Rode, ES- IV (Chemical Engineering)

Thirty-eight existing Distinguished Visiting Professors were given extension of tenure for the next academic year. For next academic year (2021-22) a total of 54 Distinguished Visiting Professors shall be conducting classes in various AICTE approved engineering colleges under the subject scheme.

AICTE-INAE Teachers Research Fellowship

Indian National Academy of Engineering (INAE) launched AICTE-INAE Teachers Research Fellowship Scheme jointly with AICTE during 2013, for Engineering Teachers to pursue Doctoral Research in Central Laboratories under Council of Scientific and Industrial Research (CSIR)/ Defence Research and Development Organization (DRDO)/ Department of Space (DOS)/ Department of Atomic Energy (DAE). The Ph.D degree is awarded by AcSIR for CSIR, IIST for DoS, DIAT for DRDO and corresponding institution of concerned DAE lab.

To implement the scheme effectively, the AICTE-INAE Teachers Research Fellowship (TRF) Scheme Committee was constituted with members from INAE Fellowship and representatives from AICTE, INAE, CII, CSIR, DRDO, DOS and DAE.

AICTE proposed to merge the scheme with AICTE QIP scheme from January 2020. The documents of existing 14 TRF candidates for academic year 2020-21 have been handed over to AICTE and QIP Centre, IIT Guwahati for further actions.

AICTE-INAE Travel Grant Scheme for Engineering Students

Indian National Academy of Engineering (INAE) launched AICTE-INAE Travel Grant Scheme for Engineering Students jointly with AICTE in 2013 to provide financial support to pre-final and final year Bachelor's and Master's Level engineering students for presenting a research paper in an international scientific event (conference/seminar/symposium/workshop/exhibition etc.) in order to encourage engineering students to engage in research.

The scheme facilitates a student to travel abroad and take part in presenting his/her research work in International Platform by providing of 100% Registration Fee, 100% Visa fee, 50% of the actual Airfare for discounted / concessional air ticket, and local travel from the Engineering College/ Institution to the nearest airport and back. Maximum financial support per student towards registration, concessional travel expenditure and visa fees, is limited to Rs. 1 lakh.



AICTE-INAE Travel Grant (TG) Scheme Committee comprising of INAE Fellows from different Engineering Sections has been constituted to review the operation of the scheme regularly and select deserving candidates as per defined criteria.

The Scheme was promoted by AICTE through print media and by sending mails to Principals of AICTE approved Engineering colleges. Due to outbreak of COVID-19, the scheme was not operational from April 2020- October 2020. A modified SOP was proposed to allow students present their research work online in International Conferences. AICTE accepted the SOP with the condition of reimbursing only registration fee up to Rs. 25000 for students presenting their research paper/poster/project in International Conferences in virtual mode. The scheme resumed in November 2020. Only 8 students could be selected from April 2020 till March 2021.

INAE Travel Grant Scheme

INAE is implementing the INAE Travel Grant Scheme with the objective to provide partial travel assistance and registration fees to Bachelor's and Master's Level engineering students for presenting a research paper in an international scientific event (conference/ seminar/ symposium/ workshop/ exhibition etc.) in order to encourage engineering students to engage in research.

Due to COVID -19 pandemic, very few nominations were received in the year as physical travel was restricted. In addition, most conferences were conducted online. Hence, the Guidelines were revised and financial support for Online Participation was also provided under the scheme in addition to Physical Participation for presenting a research paper in an international scientific event (conference/seminar/symposium/ workshop/exhibition etc.). The details of financial support provided under the scheme are as follows:

- a. **Physical Participation:** The reimbursement of 100% Registration Fee, Visa Fee and 50% of the actual Airfare for discounted /concessional air tickets in case not claimed from any other source. Actual fare not exceeding AC II Class train fare will be admissible for travel from the Technical Institution to the nearest airport and back. The maximum financial support per student for all above reimbursements is limited to Rs. 1 lakh.
- b. **Online Participation:** The reimbursement of 100% registration fees incurred by the candidate in case the paper was presented online through video conference.

Two students were selected under the scheme during the Financial Year 2020-21. Nominations are being invited for the current year under both Physical Participation and Online Participation modules.



Events Organized by Local Chapters

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

INAE Kolkata Local Chapter

- (i) **Webinar on “Artificial Intelligence & Ethics” on 15th September 2020 by Prof. Anupam Basu, FNAE, Director, National Institute of Technology, Durgapur Professor-on-lien, Department of Computer Science and Engineering, IIT Kharagpur.**

INAE Kolkata Chapter celebrated National Engineers’ Day on 15 September 2020 and on this occasion, Prof. Anupam Basu, FNAE, Director, NIT Durgapur and Professor-on-lien, Department of Computer Science and Engineering, IIT Kharagpur delivered the *Engineers’ Day Lecture* on “Artificial Intelligence and Ethics”. In view of the world pandemic, this lecture was arranged in virtual mode in the evening hours of the day. This was attended by 85 participants from different parts of the country including several INAE Fellows, INAE Young Associates, practising engineers, professors, and students from the different engineering institutes. In his talk, Prof. Basu discussed the ever-increasing presence of Artificial Intelligence in every facet of our modern life. He vividly addressed the ethical issues which are rooted in the technology itself. His talk was well received by the audience and it raised very interesting and enthusiastic discussions among the participants.

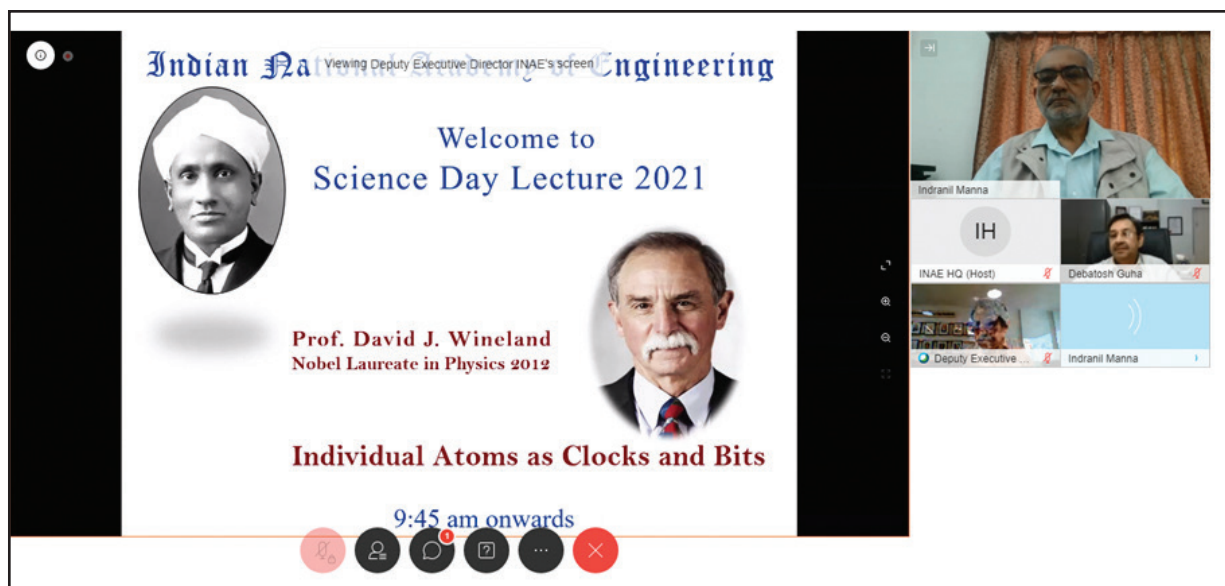
The meeting began with a formal welcome address by Prof. Bhargab B. Bhattacharyya, President, INAE Kolkata Chapter. He briefly described the aim and goal of INAE in general, including the activity of the Local Chapter. The founding President of the Chapter, Prof. Sankar K. Pal, National Science Chair, Distinguished Scientist and former Director, Indian Statistical Institute, Kolkata, addressed the audience and explained the significance of National Engineers’ Day. He also encouraged the young engineers to elevate their career with INAE. Prof. Debatosh Guha, Secretary, INAE Kolkata Chapter conducted the proceedings of the meeting and also briefed the audience with various recent technical activities of Kolkata Chapter.

- (ii) **National Science Day Lecture on “Individual Atoms as Clocks and Bits” on 28th February 2021 by Professor David J. Wineland, Nobel Laureate in Physics 2012 University of Oregon, USA**

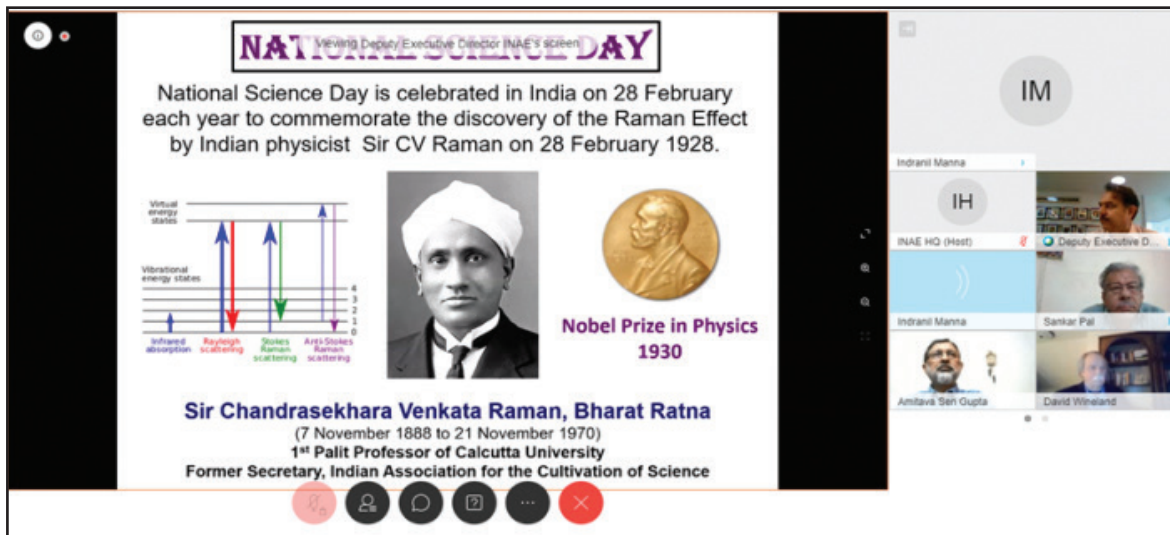
National Science Day in India is celebrated on 28 February every year to commemorate the invention of the Raman Effect by Bharatratna Sir C. V. Raman. On this occasion, the Indian National Academy of Engineering (INAE) organized the *Science Day Lecture* delivered by **Professor David J. Wineland**, Nobel Laureate in Physics 2012, University of Oregon. Prof. Wineland talked on “**Individual Atoms as Clocks and Bits**”. Owing to the restrictions due to the worldwide pandemic, the event was organised online on WebEx platform on Sunday, 28 February 2021 at 9:45 AM. INAE Kolkata Chapter was the host. Prof. Indranil Manna, President, INAE presided over the function which was moderated by Prof. Debatosh Guha, Secretary, INAE Kolkata Chapter. Padma Shri Prof. Sankar Kumar Pal, former Director, ISI, Kolkata and Dr. Amitava Sengupta, former Outstanding Scientist, NPL-New Delhi, were present in the panel.

Apart from the scientific innovations made by him and his contemporary scientist, Prof. Wineland also shared his personal life which was truly motivating and inspiring to the young minds. This Science Day event was attended by more than 100 young researchers, engineers and Fellows from different Colleges, Institutes, and Universities all over India.

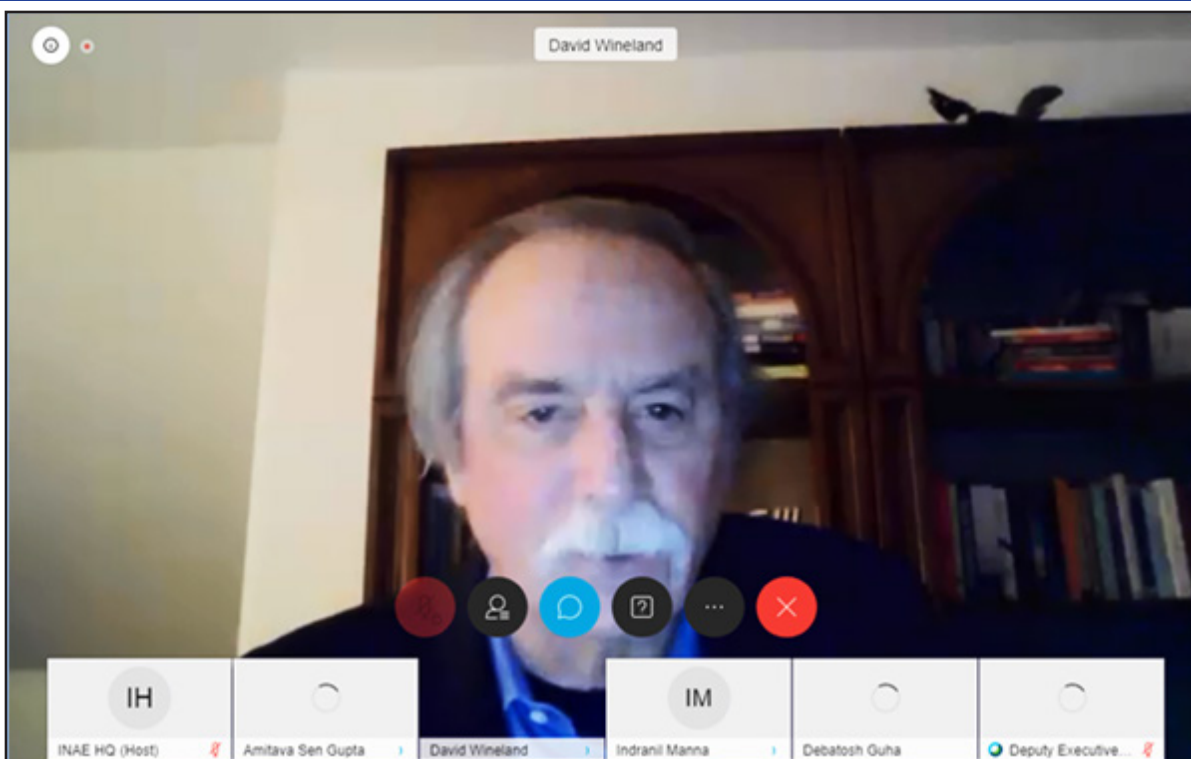
A few snapshots of this online event are enclosed below:



Prof. Indranil Manna, President INAE giving the welcome address.



Prof. Wineland and other panelists during the welcome speech by the President.



Prof. David J. Wineland delivering his lecture.

INAE Bangalore Local Chapter

(i) INAE webinar on “S&T Contributions of the Bangalore Region to the National Efforts against COVID-19” on the occasion of National Engineers Day on 15th September 2020

INAE Bangalore Chapter organised an INAE webinar on “S&T Contributions of the Bangalore Region to the National Efforts against COVID-19 on the occasion of National Engineers Day on 15th September 2020. There were 5 presentations in the Webinar ; (i) Prof Raghavan Varadarajan , IISc on “A Protein Sub-unit Vaccine for COVID-19” ii) Shri JJ Jadhav, Director, CSIR-NAL on “S&T Contributions of CSIR-NAL to the National Efforts against COVID-19”, also mentioning contributions by other CSIR Laboratories (iii) Shri MV Gowtama, CMD, BEL on “BEL’s Contributions against COVID-19” (iv) Dr NS Kumar , Associate Director, DEBEL-DRDO on “Contributions from DEBEL -DRDO for COVID-19” and (v) Prof Rahul Roy, IISc on “Monitoring Immune Response in COVID-19 Infections” , also mentioning other initiatives from IISc. Dr VK Aatre, former SA to RM, DG, DRDO and Secretary, Dept. of Defence Research, MOD and current Chairman, INAE BC made a brief introductory address on the COVID-19 situation in the country and the national efforts towards its treatment and containment. Prof KJ Vinoy, IISc proposed a vote of thanks on behalf of EC of INAE BC. The webinar was attended by more than 40 Fellows/Young Associates/ Student Awardees.

(ii) Webinar talk by Mr. S. Narender, Defence Research and Development Laboratory on “Thermo-Structural Testing of One-to-One Aerospace Structures using Infrared Heating” on November 26, 2020

INAE Bangalore Chapter organized a Webinar talk by Mr. S. Narender, Defence Research and Development Laboratory on “Thermo-Structural Testing of One-to-One Aerospace Structures using Infrared Heating”

on November 26, 2020. The talk was given by Mr. Narender, DRDO, who is an INAE Young Engineering Awardee. The talk focussed on aerodynamic heating in Aerospace vehicles like missile and space systems, which fly at high Mach numbers. The talk discussed about creating an environment on the ground to simulate close to the actual flight conditions. This is needed so that the designed airframe can be structurally qualified prior to the actual flight. The generation of controlled time-varying temperature/heat flux and pressure/structural loads on airframe sections using short-wave infra-red heating as discussed. The talk was attended by 30 people. It was followed by a lively question and answer session.

(iii) Webinar talk by Dr. Ravishankar Krishnaswamy, Principal Researcher, Microsoft Research India on “Recent Algorithms and Systems for Nearest Neighbour Search” on December 24, 2020

INAE Bangalore Chapter organized a Webinar talk by Dr. Ravishankar Krishnaswamy, Principal Researcher, Microsoft Research India on “Recent Algorithms and Systems for Nearest Neighbour Search” on December 24, 2020. The talk was given by Dr. Ravishankar, Microsoft Research, who is an INAE Young Engineer Awardee. It focused on deep learning-based embeddings, which are used in application domains such as information retrieval and computer vision owing to their ability to capture diverse types of semantic information between the different entities in a dataset. It focused on a fundamental challenge that arises in fully realizing the potential of these embeddings, which is efficiently retrieving the approximate closest vectors to any given query vector from the vectors of the base dataset. The talk described approximate nearest-neighbour search (ANNS) and gave details of the type of techniques that can be used to build efficient scalable systems for this fundamental computational problem.

(iv) Webinar talks by Prof. M. L. Munjal, FNAE and Professor, IISc, Bangalore -on January 28, 2021 on “Controlling Urban Environment Noise through Mandatory Noise Limits”

INAE Bangalore Chapter organized a webinar talks were delivered by Prof. M. L. Munjal, FNAE and Professor, IISc, Bangalore on January 28, 2021 on “Controlling Urban Environment Noise through Mandatory Noise Limits”. He headed the National Committee for Noise Pollution Control (NCNPC), which has been issuing Gazette Notifications prescribing noise limits as well as rules for regulation and control of noise pollution in the urban environment, right from its inception in 1997 for 18 years. He touched upon noise pollution (regulation and control) rules, permissible noise exposure for industrial workers, and noise limits for diesel generator sets, portable gensets, noise firecrackers, and vehicles. The talk was attended by 35 people. It attracted a large number of diverse questions from the audience.

(v) Webinar in the series of Frontiers of Engineering on “River Water Disputes” by Prof. K.G. Ranga Raju on February 18, 2021

The fourth INAE-BC Webinar talk was delivered by Prof. K.G. Ranga Raju on February 18, 2021. His talk titled “River Water Disputes” provided a fascinating perspective on river water disputes. It brought out the societal implications of engineering and how it is interlinked with several other aspects. Prof. Ranga Raju pointed out that the resolution of these disputes required addressing political sentiments, legal aspects, technical issues, and treaty requirements. As examples, he discussed three disputes in which he was personally involved, namely, Varuna Canal (Mysore and Mandya districts), Krishna Basin (Karnataka, Maharashtra, and AP), and Baglihar Dam (India and Pakistan). These disputes were at the state level, national level, and international level, respectively.

(vi) Webinar in the series of Frontiers of Engineering on “Quantum Technology: Promises and deliverables” by Prof. Arindam Ghosh, Indian Institute of Science, Bangalore on March 25, 2021



INAE Bangalore Chapter organized Webinar in the series of Frontiers of Engineering on “Quantum Technology: Promises and deliverables” by Prof. Arindam Ghosh, Department of Physics, Indian Institute of Science, Bangalore on March 25, 2021. In his presentation, Prof. Ghosh briefly covered the use of quantum physics to advance technologies beyond their classical performance limit has become a new focus in global R&D. Such quantum enhanced technologies promise paradigm shift in computing, communications, sensing and metrology, impacting areas from device architectures to algorithms for artificial intelligence and machine learning. The success of Quantum technologies will require a synergistic approach from fundamental physics, material science and engineering. Prof. Ghosh further outline the foundational aspects of quantum technology, provide a glimpse of national and international investment, and end with an outlook to ongoing and future research opportunities

INAE Mumbai Local Chapter

(i) Webinar on “Hypothetico-Deductive Construction of New Knowledge in Industrial R&D and Academic Research on occasion of the National Engineers’ Day on Tuesday 15th September 2020.

Prof Vijay M. Naik – Department of Chemical Engineering – IIT Bombay gave a talk on the topic “Hypothetico-Deductive ‘Construction’ of New Knowledge in Industrial R&D and Academic Research” on the 15th of September, Engineers’ Day, from 5 pm onwards. This was the second talk in the Webinar series of the INAE Mumbai Chapter and was hosted by INAE Headquarters on their national WebEx platform. The event was well attended with over 100 participants. Prof A.K. Suresh Ex Dy Director IIT Bombay and co-Chair, INAE Mumbai Chapter, welcomed the gathering and introduced the speaker. In his brief address, Prof Suresh recalled the many contributions of Bharat Ratna Sir M Visveswaraya, one of the architects of modern India, and his sterling qualities of head and heart. He then proceeded to introduce the speaker, Prof Vijay M. Naik who after a distinguished career in Industrial R&D marked by several innovations in the FMCG sector, continues to be active in research as an Adjunct Professor at IIT Bombay. Prof Naik also contributes significantly to the profession in various capacities, including as a member/chairperson of several grant-making committees, research advisory bodies of CSIR Laboratories etc.

Prof Naik followed up with his lecture, in which he began by acknowledging the visionary insights of Bharat Ratna Visveswaraya regarding the role of technology in social and economic transformation. He went on to explain how technology predates even Homo Sapiens and then discussed how empirical observations and serendipity have been not only the foundations of many manmade technological artefacts but also the triggers for discovery of most scientific laws of nature. According to him, human creative intuition has been the source of articulating a candidate hypothesis which tries to identify the magical hidden pattern underpinning chaotic empirical observations. Deduction is the art of searching for a logical understanding and implications of an articulated assertion. But ultimately, we must accept what Richard Feynman says, -- we do not understand what we cannot create..... until we create. This is the spirit of scientific enquiry and the basis of “construction of new knowledge”, as well as refuting or improving “existing knowledge”, transcending revered texts. This paradigm of construction of scientific knowledge is valid for both Natural Sciences and Engineering Sciences. Any meaningful Industrial R&D is not merely application of science. It is a cognitive activity of creatively constructing new knowledge, just as any worthwhile Academic Research should ideally be. Therefore, although their domains and purpose are different, the mind of an adventurous Engineer engaged with a breakthrough Product Development and the mind of a true Academic engaged with leading edge research in Science, exhibit similar ways of working. The talk presented a case study of such hypothetico-deductive ways of working in avant-garde Academic Research in the area of Neuro

science, as well as Industrial Product Development in the area of distribution of frozen foods. The talk also briefly touched upon the challenge of nurturing such Creative Talent in Industrial R&D Labs, and the need of awakening minds of Engineering Students towards epistemology of science.

The talk was followed by a lively discussion session moderated by Prof Suresh, in which the attendees sought Prof Naik's views on various philosophical and practical aspects of research, innovation and development. The event was brought to a closure with a formal vote of thanks by Secretary, INAE Mumbai Chapter.

(ii) Lecture on 700 MWe Indian Pressurized Heavy Water Reactor on October 13, 2020

A lecture on 700 MWe Indian Pressurized Heavy Water Reactor (PHWR) was delivered by Shri A.K. Balasubrahmanian, Director (Technical), Nuclear Power Corporation of India Limited (NPCIL) to INAE members on October 13, 2020. Dr. R.B. Grover, Member, Atomic Energy Commission was moderator for this lecture. The lecture was broadcast live through Cisco Webex platform as a webinar. NPCIL, a public sector enterprise, under the Department of Atomic Energy (DAE), is solely responsible for design, construction and operation of water-cooled nuclear power plants (NPP) in India. The lecture was perfectly timed, as the first unit of 700 MWe PHWR achieved the first controlled chain reaction on July 22, 2020. While introducing Indian nuclear power programme, the lecture focused on pressurized heavy water reactor technology, which is the mainstay of Indian nuclear power programme. Currently, India is operating 22 NPPs, of which 18 are PHWRs, two units are boiling water reactors and pressurized heavy water reactors each. The operating PHWRs are of 220 MWe and 540 MWe capacities and after gaining design, construction and operation experience of these units, the latest design is of 700 MWe capacity.

The speaker described Indian journey of PHWRs i.e. how from the first unit, which was constructed in collaboration with Canada; the country has kept on adding to the design and safety of subsequent units. After achieving standardization in 220 MWe PHWRs, for economy of scales 540 MWe PHWRs were designed, of which two units are in operation. Realizing that the reactor core of 540 MWe has potential to generate higher fission power, ensuring safety margin, it was decided to design a reactor of higher fission power using the same core. This endeavour culminated in the design of a reactor with 2166 MW thermal power and 700 MW electrical output. The talk emphasized that over the years, NPCIL / DAE and the Indian industry have achieved complete 'atmanirbharta' in this technology.

Shri Balasubrahmanian then focused on the main design and safety features of 700 MWe PHWRs. He informed that many first of kind (FOAK) systems are introduced in the design and design extension conditions are explicitly addressed through design and accident management programme. With all the safety features, design of 700 MWe PHWRs provides assurance that with containment remaining intact, even for the worst postulated accident, there is no need to relocate public from the neighbourhood of 700 MWe NPPs.

PHWRs have coolant channels, feeders, headers and steam generators constituting core flow path. Since PHWRs have a positive coefficient of void reactivity, in order to limit this positive reactivity, 700 MWe PHWR has adopted a concept of interleaving of feeders, so as to distribute voids uniformly in core in the postulated accident of loss of coolant. This configuration is introduced for the first time in any PHWR in the world. In the design of plant buildings, nuclear buildings are supported on a common raft for improved structural performance, particularly under seismic conditions. PHWRs require regular fuel loading and in order to handle increased fuel handling load, a Mobile Transfer Machine is introduced for new and spent fuel transfer. This initiative is aimed at operational ease, less maintenance and surveillance efforts and lower man-rem burden during operation and maintenance.

In 700 MWe PHWRs, to ensure that local power remains within limits and thereby to maintain fuel safety, a new protection in the form of regional overpower trip is introduced on both shutdown systems.

In NPPs, one of the important postulated events is station blackout, which involves simultaneous loss of off-site and on-site power supplies. To handle this situation, a new system called passive decay heat removal system is introduced, which while ensuring natural circulation through thermos phoning, preserves steam generator inventory. This system is in addition to the systems used in operating PHWR units for handling station blackout. In containment design, initiatives are taken to reduce leakage by way of providing steel liner on the inner containment. For containment pressure and radioactivity management, containment spray system is provided.

Capability of handling design extension conditions is enhanced with provisions of passive hydrogen recombination units, containment filtered venting system and by making provisions to introduce cooling water in important plant systems from outside reactor building to address situation of unavailability of designed onsite power and water supplies.

At present, six units of 700 MWe PHWRs are under construction/commissioning. For rapid capacity addition through 700 MWe units, Government of India has accorded administrative approval and financial sanction for ten more units to be implemented in Fleet Mode. For meeting the timeline of this ambitious plan, NPCIL has adopted standardization of design, utilizing 3D integrated engineering environment, standardized procurement specifications and going for bulk procurement of multiple units.

After the comprehensive presentation, Shri A.K. Balasubrahmanian answered questions of the participants covering a wide area viz. design, safety analysis, procurement and project implementation.

(iii) Webinar on “Flight demonstration of Indigenous hypersonic air-breathing cruise vehicle” on 10th November 2020

A webinar on the above topic was held on 10 November 2020 from 5 pm onwards, on the INAE’s national platform, under the auspices of the INAE Mumbai Chapter. This was the Chapter’s fourth webinar in the series. The speaker was Prof Debasis Chakraborty, formerly of DRDO and currently the Director of the Centre for Propulsion Technology at IIT Bombay (and concurrently a Professor in the Aerospace Department of the Institute). Prof Chakraborty has been intimately involved with the development which culminated in the recent demonstration of the hypersonic air-breathing cruise vehicle. The webinar was moderated by Prof A. K. Suresh, Co-Chair, INAE Mumbai chapter.

Starting with the intense determination of the two brothers Orville and Wilbur Wright at Kitty Hawk, North Carolina, and their success, the aspiration of flying at higher and higher speed in the atmosphere has led the mankind to a position where it is possible to conceive of aircrafts flying at speeds more than few times that of sound in air. When the flight is in hypersonic regime ($M_\infty > 5.0$), the burning of fuel must occur at supersonic speeds inside the combustor to allow the possibility of heat addition and minimise the total pressure loss and so, thrust loss. In turn, this allows propulsive efficiency of the hypersonic systems to be brought up to meaningful values and also contribute to reduced vehicle size and weight. The success of efficient design of such a trans atmospheric hypersonic vehicles depends largely on the proper choice of the propulsion system which is capable of producing large thrust, demanded by the system. This type of vehicle uses supersonic combustion ramjet (scramjet) propulsion system.

The development of hypersonic air-breathing cruise vehicle has tremendous applications in high-speed transport, space access, national defence, etc. It is attractive for military operations and can provide significant

payoff for offensive strike against time critical, hardened, deeply buried, and heavily defended targets due to its longer range, shorter response time and enhanced effectiveness. Its reduced tracking by ground-based radars compresses enemy's decision-making window, effectively enabling the hypersonic attacker to get inside an adversary's command, control, and battle management cycle.

Although, various countries including USA, Russia, China, UK, France, and India are in the race to develop hypersonic airbreathing cruise vehicles; only a few practical flight tests of these vehicles have been conducted worldwide so far. Extensive R&D efforts are continuing for the design and testing of scramjet combustors for hypersonic vehicles. The flight trial of hypersonic air-breathing cruise vehicle (X-51) by USA for 210 sec duration is close to hypersonic weaponization program. Russia and China are also claiming the successful demonstration of hypersonic air breathing cruise missile; but no information is available in the open literature. Recently, on September 7, 2020 DRDO, India has successfully test flown a vehicle integrated hydrocarbon fuelled scramjet engine (cruise vehicle) in an autonomous mode. The cruise vehicle is put atop a solid rocket booster (launch vehicle) and carried to 32 Km altitude at Mach 6 conditions. The heat shield fairings which protected the cruise vehicle from aerodynamic heating during ascent phase were separated and the hydrocarbon fuelled scramjet engine was ignited. The vehicle flown in power-on condition for 24 seconds before plunging into the sea. While developing this vehicle, number of complex technologies including aero-thermodynamics configuration design & testing, CFD capabilities, panel separation dynamics, hypersonic air intake characterization, scramjet Combustor design, hot structure design, split composite airframes, coatings, material characterization etc. were developed indigenously. The maiden flight demonstration has proved these complex technologies and design tools for the development of hypersonic air breathing vehicles and put India in the league of the few advanced nations which possesses this complex technology.

In his lecture, Prof. Debasis Chakraborty explained different air-breathing propulsion systems (turbojet, ramjet, and scramjet) applicable in different flight regimes and compared their performances. He mentioned that different solid fuel ramjet and liquid fuel ramjet missiles are developed indigenously and deployed at different parts of the country to safeguard the territorial integrity of the country. The advantage of hypersonic missile and world scenario of its development were briefly mentioned. He described in detail the use of high-fidelity numerical simulations (CFD techniques) for solving the panel separation dynamics and scramjet combustor design. In the absence of full-scale testing facility in our country to simulate such high-speed flow features, the design was mainly carried out through CFD simulations. Store Separation Dynamic (SSD) suite comprising of grid-free CFD solver and 6 Degree of Freedom (DOF) trajectory program was indigenously developed and used to design the separation events of nose panel and cylindrical panel separations of HSTDV vehicle. To compare the computed result, a ground test was planned in a long-range sledge facility which can only simulate the flight dynamic pressure not the flight Mach Number. Very good comparison of the simulation result for ground test condition with test data give confidence to the designer to rely on the CFD results for ensuring safe separation of the panels in the flight.

CFD also played an important role to develop the hydrocarbon fuelled scramjet combustor for the HSTDV vehicle. The numerical tools for reacting flow simulation were validated extensively by comparing existing experimental data available in open literature. The effect of grid, turbulence model and other physical and chemical models in the results were systematically studied and the numerical tool was employed in the exercise. Various flow field variables obtained from the reacting numerical simulations were closely examined and performance parameters were optimized. The geometry arrived through CFD simulation not only solved the severe thermal problems of the fuel injection struts but gave very good performance of

the scramjet combustor which was adequate to overcome the drag to ensure cruise mission. The simulation results match very well with the experimental data obtained from connect-pipe mode test and free-jet test facilities. End – to -end simulation (employing non-reacting simulation in vehicle outer surface and intake and the reacting simulation in the combustor) at different angles of attacks, altitudes, equivalence ratios provided all aero-propulsive performance parameters required for mission design.

The speaker stressed the need to have exhaustive validation of the numerical tools before putting into design studies and mentioned that numerical techniques have become very much matured to handle any challenging complex problem. The recent flight trial of HSTDV has provided particularly good confidence in the self-reliance (Atmanirbhar) in hypersonic technologies. The presentation was concluded with the presentation of flight video of HSTDV.

(iv) Webinar on “High Intensity Super Conducting Proton Accelerators (HISPA): Challenges and Achievements” on 17th December 2020

INAE Mumbai Chapter organised a webinar on High Intensity Super Conducting Proton Accelerators (HISPA): Challenges and Achievements on 17th Dec 2020. At the beginning of the talk, the subject was introduced by Dr. Ajit Kumar Mohanty, Director, Bhabha Atomic Research Centre (BARC). The webinar was delivered by Dr. Srinivas Krishnagopal, Head, Ion Accelerator Development Division BARC. The session was moderated by Dr. R. B. Grover, Co-convenor, INAE Mumbai Chapter, Emeritus Professor HBNI.

The Large Hadron Collider (LHC) at CERN is an example of a high energy superconducting proton accelerator. The next frontier is the high intensity frontier. A High Intensity Superconducting Proton Accelerator (HISPA) would have an intensity (or proton current) an order of magnitude greater than the LHC. HISPA has a number of important societal and discovery science applications: (i) energy security through Accelerator-Driven Reactor Systems (ADS) that can be used to breed thorium; (ii) for medical applications through the production of radio-isotopes for cancer therapy and medical imaging; (iii) production of Radio-active Ion Beams (RIB) for discovery science in nuclear physics; (iv) neutrino production for discovery science in high-energy physics; (v) Spallation Neutron Sources (SNS) for basic and applied research in a wide variety of fields.

There are many scientific and technological challenges in building such a high intensity accelerator. The high intensity of protons results in nonlinear motion of the particles, which is difficult to study, but essential because it can lead to the formation of beam halos. These halos can lead to loss of high energy particles from the accelerator, which can turn the surroundings radioactive; hence the halos must be well studied and controlled. The high intensity also requires incredibly careful design to ensure complete control of the proton beam, to ensure reliable operation of the accelerator. The superconducting accelerator requires a large and complex cryogenics system that allow the accelerator to operate at -271°C ! Finally, for maximal use of the accelerator it has to be operated in a continuous mode (CW mode) which is so challenging that no country has yet succeeded, though there are very serious CW HIPSA projects in the US and China.

For the applications described above, India has taken HISPA technology very seriously. In any proton accelerator, the low energy part (up to around 10 MeV) is the most critical. Therefore, as a first step, the Bhabha Atomic Research Centre (BARC), Mumbai, took up the development of a Low Energy High Intensity Proton Accelerator (LEHIPA), which will accelerate a 10-mA proton beam to 20 MeV. After ascending a steep learning and technology curve, protons were accelerated to 3 MeV in 2019, using a four-vane Radio-Frequency Quadrupole (RFQ), and are poised reach first 10 MeV and then 20 MeV later this year. The centrepiece of LEHIPA is the successful development of the RFQ, which is perhaps the most difficult

accelerator component in HISPA. The RFQ is made in four sections of length 1 m each. Each section has four vanes made of oxygen-free copper, that have been machined to tolerances of better than 50 μm , over the length of 1 m. The four sections have been aligned together to within tolerances of around 150 μm . Total RF power of around 600 kW was fed to the RFQ to achieve acceleration to 3 MeV. Other important technologies that have been mastered in LEHIPA include RF couplers, high power RF systems, low-level RF electronics, high voltage power supplies, control systems, etc. It is a matter of pride to note that almost every component in LEHIPA has been designed and developed indigenously, demonstrating largely self-reliant in this technology.

As a second step towards HIPSA technology, the Department of Atomic Energy has entered into an 'Indian Institutions and Fermilab Collaboration' (IIFC), with the Fermi National Accelerator Laboratory (Fermilab), USA, for hastening the development of superconducting accelerator technology in the country. Fermilab is interested in HISPA for neutrino applications and is build a 700 MeV HIPSA. India is participating in almost every aspect of the R&D for this accelerator. In return, Fermilab is making available to us all HIPSA technology developed by them. In addition, Indian scientists and engineers are also hosted by Fermilab for 1-2 years each, and over 15 persons have already been trained in this manner. Through this Collaboration India has designed and developed different superconducting cavities required for HISPA, as well as RF amplifiers, magnets, low-level RF systems, etc. - some of these systems are already working successfully at Fermilab. Thus, a large number of scientists and engineers have been working on HISPA technology for many years and are now quite well advanced in the field.

In order to energise the national HISPA programme, and to leverage the gains from IIFC, BARC now proposes to build a HISPA accelerator at its new campus at Visakhapatnam. This will likely be a 200 MeV, multi-purpose HISPA, that can be used for RIB, radio-isotope production, etc., and in the future can be extended to 1 GeV and used for ADS. The future of HISPA in India is both bright and intense!

(v) Webinar entitled “Engineering of carbon nanotubes and their applications” was conducted under the aegis of INAE Mumbai Chapter on 27th January 2021

A webinar entitled “Engineering of carbon nanotubes and their applications” was conducted under the aegis of INAE Mumbai Chapter on 27th January 2021. The speaker for this webinar was Dr. Kinshuk Dasgupta, a Shanti Swarup Bhatnagar Prize awardee for Engineering Sciences for 2020. The function was moderated by Dr. R.B. Grover, FNAE.

In his talk Dr. Dasgupta spoke about the large-scale synthesis of carbon nanotubes (CNTs) by fluidized bed chemical vapour deposition (FB-CVD) and floating catalyst chemical vapour deposition (FC-CVD) techniques. He discussed about the fluidization of nano-particles and different steps involving mass transfer and chemical reactions during the synthesis of CNTs. He explained the influence of different process parameters on the growth rate of CNTs leading to developing a mathematical model for the overall rate of reaction and identifying the rate controlling steps. Further, Dr. Dasgupta talked about the use of CNTs for various applications. He discussed the CNT-polymer composite beads for rare-earth extraction, functionalized carbon nanotubes for actinide separation and metal-filled carbon nanotubes as nano-magnets. Improvement of mechanical properties of ceramic and polymer matrix composites with the addition of CNTs was also showcased by Dr. Dasgupta in his presentation. These improved composites were utilized in developing Bhabha Kavach, a light-weight import-substitute bullet proof jacket for Indian Armed Forces. Dr. Dasgupta informed that the technology of Bhabha Kavach has been transferred to the industries for large-scale production. After the panel discussion, the webinar was concluded with the vote of thanks by Dr. (Mrs.) S. B. Roy.



(vi) Webinar on “Implications of NEP-2020 for Engineering Education in India” on 16th February 2021 by Prof. RK Shevgaonkar

INAE Mumbai Chapter organized a webinar on “Implications of NEP-2020 for Engineering Education in India” on 16th February 2021. The Session was Moderated by Prof A K Suresh, FNAE, Co-Convener - INAE Mumbai Chapter, and Professor - Department of Chemical Engineering, IIT Bombay and the Speaker for the session was **Prof Raghunath K Shevgaonkar**, FNAE, Emeritus Professor, IIT Bombay.

After 34 years, Indian Government approved the new National Education Policy, NEP-2020. Broadly, the policy has received appreciation from all sectors of education. The policy has evolved through a consultative process from political leaders and educationists. The first part of the talk highlights the general features of NEP-2020. Expectations from the future engineers are put forward and the implications of the NEP-2020 for engineering education, and the implementations issues are discussed in the later part of the talk.

The NEP-2020 first discusses the problems faced by the current education system and then proposes many radical reforms at academic, institutional and governance level. The first and the foremost is the GER target that needs to be achieved by 2035. At academic level, a multi-disciplinary, more flexible, student-centric structure has been proposed. A special thrust has been provided on (i) integrating vocational component in the main stream for better employability and (ii) enhancing liberal arts component for holistic developments of the students. Under institutional reforms, three types of HEIs namely research-centric HEIs, teaching-centric HEIs and degree-granting HEIs, have been proposed. It has been proposed that the affiliation system would be phased out in next fifteen years and the HEIs would be granted graded autonomy. The policy also has proposed single regulator, and evolution of the solitary discipline HEIs into comprehensive institutions. Use of technology has been amply emphasized for building inclusivity in the system.

Before discussing at the implications of NEP-2020 for engineering education, it is worthwhile to look into the kind of knowledge and skills the future engineers are expected to possess. It is clear that the future world is going to be technology dominated and the life span of technology will get shorter. The world will also be stressed for natural resources. The future engineers therefore will have to be prepared for addressing the so called ‘grand challenges’ like adequate energy, water, sanitation, food, etc., for making the development sustainable. The future engineers will need multi-disciplinary, systemic approach with innovative ideas. Global mindset with better understanding of the society, politics and economics will be the need of the hour.

In this light, although there is no special treatment for engineering education in NEP-2020, many of the proposed general reforms may impact engineering education in India. In fact, the NEP-2020 can help in removing obsolescence in technical education and can facilitate many of the changes that the current engineering education aspires to have. Engineering institutions in India should use this opportunity to restructure their programs and departments to develop tomorrow’s engineers who are quality conscious, understand societal needs, and develop technology products that make the world sustainable.

The talk has critically looked at various aspects of NEP-2020 and its impact on technical education as a whole. The NEP-2020 is forward looking but the real challenge lies in its implementation. The most important aspect will be granting autonomy to HEIs with accountability mechanism in place. Development of quality faculty and educational leaders and their unbiased deployment will be an important aspect of implementation. Engineering institutions will have to restructure their departments and programs with less rigid boundaries to inculcate multi-disciplinary culture. More hands-on training in laboratories and industries, and exposure to the real-life problems will have to be emphasized. The regulatory bodies will have to facilitate strengthening of Industry-academia partnership through movement of engineering faculty

and industry professionals beyond their territories. Industry will also have to help in providing vocational training to enhance the employability of the graduates.

All this will need a robust financial model. NEP-2020 has not provided any sustainable financial model. For engineering education, which is cost intensive, a financial model that is inclusive and sustainable will be the greatest challenge in implementation of the NEP-2020 for engineering education.

(vii) Joint Webinar on “Outlook for Nuclear Power in India- Utility Perspective” by Mr. SK Sharma, CMD, Nuclear Power Corporation of India Ltd. on 31st March 2021.

Indian Nuclear Society (INS) and INAE Mumbai Chapter jointly organized a Webinar on “Outlook for Nuclear Power in India – Utility Perspective” on Wednesday, 31st March 2021 through WebEx Platform to commemorate celebration of India’s 75th Year of Independence (Aazadi ka Amrit Mahotsav). The Lecture was delivered by Mr S K Sharma, Chairman and Managing Director, Nuclear Power Corporation of India Limited. The Introductory Remarks for the Webinar were by Mr SK Mehta, FNAE, President, INS and moderated by Dr R B Grover, FNAE, Co-Convenor, INAE Mumbai Chapter, Emeritus Professor, Homi Bhabha National Institute, Mumbai.

Abstract of the Talk: Growing concern for climate change and sense of urgency for remedial actions has contributed to hasten structural changes in the energy sector world-wide, demonstrated by the commitment towards reducing emission intensity of electricity grids. The last decade has witnessed significant advances in renewable energy and storage technologies leading to rapid fall in costs. These changes may not necessarily be disruptive for the business case of nuclear power as a source of electricity generation, but these cannot be ignored either. Nuclear power projects are characterized by high investment, long gestation periods and public apprehension about radiation - it is essential to address all three by appropriate countermeasures to take full advantage of shifting priorities. Some of these measures may be within the control of utilities whereas some others may need to be justified for other enablers such as government agencies and authorities. Nuclear Power Corporation of India Limited has undertaken a comprehensive critical review of its performance, practices and procedures to identify the lessons for developing a tool-kit to guide the transformation needed to remain in synchronism with evolving times. In spite of challenges, the outlook for nuclear power in India remains bright given the likely growth in demand for electricity and need for de-carbonization of the energy sector.

INAE Hyderabad Local Chapter

The School of Engineering Sciences and Technology (SEST), University of Hyderabad has organized the following webinars, jointly with the INAE Hyderabad Local Chapter.

S. No.	Speaker	Title of the Presentation	Date
1.	Dr. G. Padmanabham, Director, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad	Metallurgical Aspects of Additive Manufacturing	19 August 2020
2.	Prof. Satyam Suwas, Chairman, Department of Materials Engineering, Indian Institute of Science, Bangalore.	Microstructure and Texture in Processing of Metals and Alloys	21 August 2020
3.	Prof. B. S. Murty, Director, Indian Institute of Technology, Hyderabad.	Probing Materials at Small Scale: The Exciting World at the Bottom	23 August 2020



In all the above webinars more than 150 faculty/scientists/researchers/students have attended from all over the country as well as from Japan, Germany and the USA. The participants have enthusiastically interacted with the distinguished speakers.

National Workshop on Hypersonic Air-Breathing Vehicle jointly organised by National Centre for Combustion R&D, Combustion Institute and INAE Hyderabad Chapter on 26th March 2021.

National Workshop on Hypersonic Air-Breathing Vehicle was jointly organised by National Centre for Combustion R & D, Combustion Institute and INAE Hyderabad Chapter on 26th March 2021. During the Inaugural Session of the Workshop, the Welcome Address was delivered by Dr V Ramanujachari, CSIR-Bhatnagar-Fellow, IITM, followed by Address by Dr. V K Saraswat, Chairman, CI-IS. The Inaugural address was delivered by Dr Sudhir Gupta, DG(TM) DRDO, New Delhi. Extramural Research of DRDO covered by Dr. Shiv Kumar, Director, ER&IPR, DRDO; Activities of AR&DB; by Shri. Ashok Kumar Yadav, Secretary, AR&DB; and Hypersonic activities in NCCRD by Prof. S R Chakravarthy, Coordinator, NCCRD, IIT, Madras were covered in various addresses.

The following lectures were delivered during the subject National Workshop.

- (i) Lecture 1 on “Overview of Air-breathing Hypersonic Vehicle” by Dr. T.K. Ganesh Anavaradham, Project Director, HSTDV, DRDL, Hyderabad.
- (ii) Lecture 2 on “Air Intakes for Hypersonic Air-breathing Vehicle” by Dr Venkat Narayanswamy, Associate Professor, Department of Mechanical, Associate Professor, Department of Mechanical.
- (iii) Lecture 3 on “CFD Modelling of Scramjet Combustor” by Dr Debasis Chakraborty, Director, CoPT, IIT Bombay.
- (iv) Lecture 4 on “Experimental Investigations of Scramjet Combustor” by Dr BVN Charyulu, Associate Technology Director, Directorate of Propulsion, DRDL, Hyderabad.
- (v) Lecture 5 on “Nozzles for Scramjet Engine” by Shri. B. Rajinikant, Sc F, DRDL, Hyderabad.
- (vi) Lecture 6 on “Combustion Diagnostics in Scramjet Engine” by Prof. T.M. Muruganandam, Department of Aerospace Engineering, IIT Madras.
- (vii) Lecture 7 on “Flight Testing of Hypersonic Air-breathing Engine” by Mr. Lazar Chitillapilly, Professor, Department of Aerospace Engineering, IIT Madras.

INAE Kanpur Local Chapter

The 7 - Day “e-BOOTATHON 01 Virtual Labs Development” was held in association with INAE Kanpur Chapter, IIT Kanpur & AKTU Lucknow which was organized by Rajkiya Engineering College, Banda from August 04-10, 2020. The 7-day e-BOOTATHON program was organized to develop virtual experiments on an open platform. The event witnessed registration of 43 teams and a participation of 215 attendees. A total of 13 colleges were screened to qualify for the development program to make 15 teams with 60 students and 15 faculty mentors.

The e-BOOTATHON event was inaugurated by Prof. Vinay Pathak, Vice Chancellor of AKTU, Lucknow. Professor Pathak emphasized that Virtual Lab is one of the key initiatives to develop the cognitive skills of the AKTU students. Over 130 participants attended the online inauguration ceremony. Prof. S.P. Shukla, Director REC Banda, informed that Virtual Labs are mapped to seven engineering branches with Applied Sciences experiments with a total of 330 experiments mapped to the curriculum of AKTU experiments. AKTU is also taking an initiative to develop laboratories for pharmaceutical sciences as well. Prof. Subodh Wariya, Dean UGSE AKTU Lucknow stated that the Virtual Laboratory Cell will cater to the needs of students to develop hands on experience in using Virtual Labs. Prof. Kantesh Balani, PI Virtual Labs and Secretary INAE Kanpur Chapter, appreciated the e-BOOTATHON 01 event and later gave a keynote talk on the ‘Introduction to Virtual Laboratories’ and how it can be effectively utilized.

Prof. Yogesh M Joshi, Vice Chair, INAE Kanpur Chapter, appreciated the Virtual Laboratory initiative and stated that virtual labs are the need of the hour especially due to the pandemic when everyone is utilizing online platforms to a great extent. He also praised the e-BOOTATHON 01 event which helps student learn and perform experiments online.

During e-BOOTATHON, Er. Dhananjay Umrao and Er. Sheetal Singh delivered 16 sessions, where they demonstrated the development procedure and pedagogical concepts of virtual lab development. Dr. Sangeeta Arora KIET Ghaziabad, Dr. Arvind Pandey MIET Meerut, Dr. Anurag Chauhan REC Banda and Mr. T. Senthil Siva Subramanian HCST, Mathura mentored and guided the students by giving their valuable reviews which enhanced the participant's understanding of v-lab development.

The valedictory ceremony was conducted on August 10, 2020, where 15 teams from various colleges of engineering showcased their experiments in several disciplines of engineering. These teams were able to develop 23 experiments of AKTU in all. The program ended with the vote of thanks proposed by Dr. Ashutosh Tiwari to AKTU, IIT Kanpur, INAE Kanpur Chapter and TEQIP -III for supporting in the e-BOOTATHON 01. He also congratulated all the successful participants, faculty members and mentor that led to the successful development of quite a few new virtual experiments for AKTU.

INAE Delhi Local Chapter

(i) Webinar on “Enriching Engineering Education through Experiential, Collaborative, and Social Learning” on September 24, 2020 by Prof PV Madhusudan Rao, Abdul Kalam Technology Innovation National Fellow of INAE and Mehra Chair Professor, IIT Delhi

INAE Delhi Local Chapter organized a Webinar talk by Prof PV Madhusudan Rao, Abdul Kalam Technology Innovation National Fellow of INAE and Mehra Chair Professor, IIT Delhi on “Enriching Engineering Education through Experiential, Collaborative, and Social Learning” held on September 24, 2020. Brief details of the talk are given below.

Prof. P. V. Madhusudan Rao gave a webinar presentation on September 24, 2020 over MS Teams that was organized by Bharti School of Telecom, IIT Delhi, and INAE Delhi Chapter. The talk title was “Enriching Engineering Education through Experiential, Collaborative, and Social Learning.” In his talk, Prof. PVM Rao first introduced the key tenets of engineering education, especially how it should affect in cultural and social changes and contrasted with the trends of engineering education where the focus has been primarily classroom pedagogy and examination oriented. He pointed out the routine complaints that a professor makes about the lack of interest in the current-day students, as well as the complaints of the students on how they do not find the classroom teaching interesting. He pointed out that, especially in Indian engineering education the first year of the students, the students are loaded with basic physics, chemistry, and Mathematics, whereas they need to be first motivated on the aspects and impacts of their upcoming education. As a result, many lose interest in the first year itself.

Prof. Rao then shared how a curriculum change in the first year at IIT Delhi has been affected to address this critical issue of motivating the students. A new course on “Introduction to Engineering” has been initiated 8 years ago at IIT Delhi with his leadership. In the course, through the semester eminent engineering and entrepreneurial personalities are invited every about 2 weeks for a lecture and extensive interactions with the entire class of students (currently about 1100 in number). Parallely, the students are exposed to various projects where they start with basic science concepts and in a few days of group effort they come up with engineering outcomes — so show the connection between science and engineering. He also shared his rich

experience on similar design and social learning-oriented engineering innovations through the academic courses, wherein the student put in much more efforts beyond their routine work hours out of their sheer interest. Prof. Rao also connected his experiences at MIT and Stanford on similar lines of education.

To summarize, his talk pointed to the need of making efforts as the educators on how to engage the students to do something meaningful, and then drawing their interest towards the fundamentals of deeper learning through the pedagogical aspects. The talk was broadcast to the entire INAE community across the country as well as the IIT Delhi academic community, and was attended by 32 online participants, including the engineering faculty members, industry practitioners, and students. Overall, it was a fine interactive session with live exchange of thoughts following the presentation.

Brief Bio of the Speaker: P. V. Madhusudhan Rao is professor in Department of Mechanical Engineering, Department of Design and Khosla School of Information Technology at IIT Delhi. He also serves as Head of the Department of Design. His current teaching and research interests are in product design and manufacturing with special emphasis on design of medical and assistive devices. He obtained his Ph.D from IIT Kanpur. He was a guest researcher to US Government's National Institute of Standards & Technology (NIST), USA multiple times between 1996-2007. He was visiting scientist to Massachusetts Institute of Technology and visiting faculty to Stanford University. He is a Fellow of ASME. He is a recipient of Abdul Kalam Technology Innovation National Fellowship of INAE. He is also recipient of IIT Delhi's K. L. Chopra Faculty Research Award in Applied Research category in its inaugural year. He has been conferred with of 2005 Vasvik Industrial Research Award.

(ii) Webinar on “Advances in Communications Technology to Support the Convergence of Communications, Computing and Content” on February 27, 2021 by Dr. Kumar Sivarajan Chief Technology Officer, Tejas Networks

During the webinar the following was covered. The next generations of communications technology, including future releases of 5G, are being designed to serve the next generation of users, which are machines and not humans with smartphones. Computing has been rapidly virtualized into the cloud and the clouds are moving closer to the user— both human and machine. Content is overwhelmingly video, increasingly real-time, and will be driven by the demands of the artificially intelligent machine users. Finally, all of these technologies need to work in a tightly coupled fashion. Therefore, the networks that interconnect the users, content and computers need to be designed in an integrated fashion.

In this talk, Dr. Sivarajan explained the key issues in the design of these networks and how advances in communications technology are being made to support this convergence of communications, computing and content. The talk broadcast to the INAE community, and was attended by 50 online audiences, including the engineering faculty members, industry practitioners, and students. Overall, it was a very well-attended and enlightening discussion.

Brief Bio of the Speaker: Dr Kumar Sivarajan, FNAE is the Chief Technology Officer at Tejas Networks. He has nearly three decades of experience in the field of telecommunications. In 2000, he received the Swarnajayanti Fellowship from the Department of Science and Technology, Government of India, which is awarded to outstanding young scientists to pursue basic research in frontier areas of science and technology. Kumar has co-authored the bestselling book, Optical Networks: A Practical Perspective, which is currently in its third edition. He is also a recipient of the prestigious IEEE W.R.G. Baker Prize Paper Award in 1997, which is presented for the most outstanding paper reporting original work in the transactions, journals, and magazines of the societies or in the proceedings of the IEEE. Kumar was the first chairperson of the

governing council of Telecommunications Standards Development Society, India (TSDSI) which is an organizational partner of 3GPP, the global standards body responsible for formulating 5G standards. Prior to joining Tejas, he was an associate professor at the Indian Institute of Science, Bengaluru and a research staff member at the IBM Thomas J. Watson Research Center, Yorktown Heights, New York. Kumar holds a BTech in Electrical Engineering (Electronics) from the Indian Institute of Technology (IIT), Madras and an MS and PhD from the California Institute of Technology, Pasadena, US (Caltech). At Caltech he was selected for the IEEE Charles LeGeyt Fortescue Scholarship, an annual award given to only one first-year graduate student of Electrical Engineering studying in the US. Kumar received the Distinguished Alumnus Award from IIT Madras in 2013.

INAE Pune Local Chapter

A Webinar on “Does Hydrogen have a role in India’s Energy Strategy?” was organized by INAE Pune Local Chapter on 13th June 2020 wherein four speakers, viz., Dr. SSV Ramkumar, Director R&D, IOCL; Dr. Ashish Lele, Senior VP and Head, Advanced Materials and Alternate Energy, Reliance Industries Limited; Dr. RR Sonde, EVP, Research, Technology and Innovation, Thermax and Dr. P C Maithani, Advisor, MNRE, Govt. of India delivered the talks. Mr MV Kotwal, Independent Director on Boards - Sanghvi Movers Ltd. & Kirloskar Ferrous Industries Ltd and Ex-Member of the L&T Board & President Heavy Engineering was the Moderator of the webinar. A Q&A Session was held after the four speakers made their presentations which was coordinated by Mr Sachin Chugh, Chief Research Manager, Indian Oil R&D Centre. A total of 151 INAE Fellows/ Foreign Fellows/Young Associates/other invitees participated in the Webinar. The recording of the webinar has also been made available in INAE YouTube Channel and link provided on INAE Website.

International Affairs

CAETS and International Conference

CAETS 2020 Annual Meetings and Symposium on “Engineering a Better World- Smart Society”

INAE is a Member-Academy of the International Council of Academies of Engineering and Technological Sciences (CAETS) and participates in its programmes/convocations of global concern at national/international levels. CAETS is committed to enhancing the contribution of science, technology and engineering in the world and its mission is to foster effective engineering and technological progress for the benefits of the societies of all countries. CAETS Annual Meetings and Symposium are organized by one of the Member Academies of CAETS each year, wherein all Member-Academies are invited to participate.

During 2020, the National Academy of Engineering of Korea (NAEK) hosted the CAETS Annual Meetings and Symposium on “Engineering a Better World- Smart Society” which were held online from October 12-15, 2020. Experts from INAE Fellowship participated in various Committees and as nominated theme-based speakers in the Symposium. INAE was requested to nominate an expert from INAE as a Speaker during one of the Technical Sessions of the CAETS 2020 Symposium on ‘Climate Change Issues and Challenges in an Urban Environment’ held online on October 14, 2020.

The following experts from INAE Fellowship participated in the respective meetings of the Committees as per details given below.

- Dr Sanak Mishra, President INAE participated as the President, INAE and a nominated Member of the CAETS Strategy Development Working Group and Member, CAETS Board of Directors. Dr Sanak Mishra, President, INAE also participated in the Board Meeting and the CAETS Council meeting which was held on October 15, 2020.
- Dr Akhilesh Gupta, FNAE and Adviser & Head, Climate Change Programme, SPLICE, DST participated as a nominated panellist from INAE in Technical Session 4 on “Climate Change Issues & Challenges” held on October 14, 2020.
- Dr Ajay Mathur, FNAE, Director General TERI participated as a nominated Member from INAE in the CAETS Energy Committee Meeting held on October 12, 2020.
- Mr Pradeep Chaturvedi, FNAE, Vice-President, World Environment Foundation participated as a nominated Member from INAE in the CAETS Sustainable Development Goals Working Group Meeting held on September 29, 2020.
- Prof Kamala Krithivasan, FNAE, Formerly Professor, IIT Madras participated as a nominated Member from INAE in the CAETS Diversity Working Group Meeting held on October 8, 2020.
- Prof Amit Agrawal, FNAE, Professor, IIT Bombay participated as a nominated Member from INAE in the CAETS COVID-19 Special Committee Meeting held on October 12, 2020.
- Ms Alpa Sheth, FNAE Managing Director, VMS Consultants Pvt Ltd, Mumbai participated as a delegate in the CAETS Symposium on “Engineering a Better World- Smart Society”.

Subsequent to the event, the delegates from INAE were requested to forward brief reports based on their experience of participating in the CAETS 2020 Annual Meetings and Symposium and the reports received are given below.

Report by Dr Sanak Mishra, President, INAE -CAETS Convention- 2020 The National Academy of Engineering of Korea (NAEK) hosted the CAETS 2020 Convention in Seoul from 12 - 15 October. The technical sessions focused on "Engineering a Better World: Smart Society" and included sessions on Hyper-Connected Life and Sustainable Community. On account of COVID19 epidemic, the convention was held online.

As the only Engineering Academy of India, INAE is a member of CAETS. The President of INAE, Dr. Sanak Mishra, currently serves as a member of the Executive Board of CAETS. In 2019 he was also appointed as a member of the newly established Strategy Development Working Group of the Board. During CAETS Convention in Seoul in October 2020, Dr. Mishra attended and participated in the Board Meeting and the CAETS Council Meeting.

The Strategy Development Working Group is chaired by Tuula Teeri, IVA, Sweden, and comprises the following members: Oh-Kyong Kwon, NAEK; Sanak Mishra, INAE; Hugh Bradlow, Australia; David Tomlinson, RAEng, England; Friedrich Wu, CAE, China; and Ruth David, Secretariat (support), USA. Prof. Teeri presented the Draft Strategic Plan report on behalf of the group which was followed by discussions and will be put up for approval of member academies by circulation. Dr. Mishra was thanked for his inputs to the draft plan.

During the Council Meeting of CAETS, INAE came for commendation for having taken out a major volume of literature on COVID-19 in the form of a special issue of the Transactions of INAE. It was pointed out that INAE is the only Academy which has done so. INAE was also mentioned in respect of its contributions to the draft report of the Energy Committee and its active participation in the committees on Diversity and Sustainability.

Report by Mr Pradeep Chaturvedi on Consultation Meeting on 29 September 2020 CAETS Sustainability Group to meet the Sustainability Development Goals (SDG) meeting was organised by Royal Academy of Engineering, UK online on September 29, 2020 at 4.30 P.M. IST. 18 persons participated in the meeting from 14 different country member committees. The meeting was conducted by Mr. Thermolinson, David of Royal Academy of Engineering. He briefed members about the need, objectives, and expectations from this CAETS Sustainability Working Group. He emphasised that the purpose of the working group is to share knowledge and best practice on how academies and engineering communities are influencing, communicating, and overseeing national sustainability plans and broader SDG targets, with a view to developing CAETS level guidance, messaging or advice that can be fed into discussions around COP-26 in Glasgow in November 2021.

He identified the three focus topics as follows:

1. In what ways are Academies demonstrating leadership around sustainability and the SDGs at a national level?
2. How the vital roles of the engineering in delivering the SDGs is reflected in national sustainable development plans, and are their good examples of stewardship of these plans from the engineering community?
3. How the vital roles of the engineering in delivering the SDGs is reflected in national sustainable development plans, and are their good examples of stewardship of these plans from the engineering community?

He invited Mr. Shane McHugh to make an opening presentation on approach of the Sustainability Group under Royal Academy of Engineering, UK. He mentioned that the Academy has established a challenging high-level goal of harnessing the power of engineering to build a sustainable global society and an inclusive UK economy that works for everyone. He further mentioned that the academy is focusing on sustainable economy, net zero policy in UK, engineering systems approaches to zero carbon objective, academy's net zero influencing and the positive response from UK government.



INAE Intervention

INAE was also requested to make a presentation on its efforts to support SDGs in India. In his presentation Mr Chaturvedi had mentioned that NITI Aayog has the overall responsibility of implementation of SDGs in the country. The scientific and engineering inputs are being guided by the Department of Science and Technology. INAE works in close cooperation with both these agencies.

INAE has several committees like: Committee for Consultation with the Principal Scientific Advisor to the Government; Digital Platform Committee; Forum on Technology Foresight and Management; Forum on Engineering Intervention for Disaster Mitigation; Forum on Civil Infrastructure; and Forum on Energy.

All these committees have been taking into consideration various aspects of SDGs and the engineering input requirement at the national level and reflecting the same in their reports. INAE has also conducted important studies that have direct bearing of SDGs and these reports have been discussed with concerned official agencies and a number of them are found in the policy statement or implementation strategies. Some of them are given below:

- Engineering Interventions Necessary for Achieving 175 GW of Renewable Power by 2022
- Study on Clean and Green Energy in Urban Development
- Technologies for Overcoming Vulnerabilities during Pandemics.
- Study report on “Technologies for Healthcare Sector in India”
- Study report on “Water Resources Management”
- Study report on “Assessment of Civil Engineering inputs for Infrastructure Development – including Smart Cities”
- Study report on “Urban Transportation – Challenges and Way Forward”
- Reports on Technology Foresight and Management on topics of sustainable development.

As regards COVID-19 and its impact of communication delivery INAE has been supporting the digital platform for all communications. INAE also studied and brought out a special number focusing on Technologies to Mitigate the Effect of COVID-19.

INAE has prepared a White Paper on Technological Preparedness for Dealing with National Disruptions on request of the Principal Scientific Advisor to the Government of India for their consideration. The government appreciated the involvement of INAE in attaining SDGs. Representatives of other member committees also made presentation on efforts of their academies.

Discussion of Working Group ‘COVID-19 Special Committee’ of CAETS – Report by Prof Amit Agrawal

The CAETS 2020 Annual Meeting and Symposium was held in Seoul from 13-14 October 2020, hosted by The National Academy of Engineering of Korea. Most International participants attended the event online. The Annual Meeting was preceded by a discussion on the unfortunate situation created by the ongoing pandemic. A ‘COVID-19 Special Committee’ has been formed in view of the prevailing situation, to seek alternative solutions to restore a safe and healthy society from an engineering point of view and propose governmental policy.

This COVID-19 Special Committee comprises the following members:

- Youn Hee Choi, (Chairman) Senior Research Fellow, Korea Institute for Industrial Economics & Trade
- Byung Geon Rhee, CEO, SCM Lifescience Co., Ltd. Chairman, Int’l Vaccine Institute (IVI) Korea Support Committee

- Kyu-sung Lee, Executive Vice President, SAMSUNG BIOLOGICS Co., Ltd.
- Byungjoo Park, Vice President, National Academy of Medicine of Korea (NAMOK)
- Jong-Gu Lee, Professor, Dept. of Family Medicine at Seoul National University College of Medicine
- Chungwon Lee, Ph.D., Bioengineering, Seoul National University
- Geoff Chase, Chair Professor, University of Canterbury
- Mohammed Homman, CEO, Vironova
- Hiedaki Koizumi, Distinguished Fellow, EAJ
- Amit Agrawal, Institute Chair Professor, Indian Institute of Technology Bombay

The first agenda of the Committee was to understand each country's quarantine experience and related engineering technologies. In this context, Prof. Amit Agrawal, INAE's nominee to the Committee made a presentation.

The following are the salient points from the presentation:

- The Aarogya Setu App helped track infections in the beginning of the pandemic and gave crucial time to the Indian government agencies to prepare for the worst
- The number of tests currently done in the country are about 7 times of the WHO's advise
- A clinically approved drug has been proposed as an option for treatment, while vaccine development is going on in the country
- The 'Transactions of INAE' brought out a Special Issue on 'Technologies for Fighting COVID19', perhaps the first journal in the world to do this. Copies of the Special Issue have been shared with the Principal Scientific Advisor of India, and several other government bodies
- 49 technologies/solutions are described in the Special Issue, and the published articles have received good attention as evident from the large number of accesses for the articles
- INAE has identified some focus areas, and INAE is willing to collaborate with Academies from other countries in these focus areas and COVID-19 related issues
- As a lesson learnt, we should build capacity in 'good' times so that we are adequately prepared to tide over 'bad' times.
- The need to re-engineer the several technologies available in the country to address the pandemic situation was also emphasized
- As an example, the test kit developed by IIT Hyderabad, built for some other disease but reengineered for detecting COVID-19, was mentioned
- It was proposed that the various International Academies could combine their expertise to study the dynamics of disease transmission, which may be climate and geography dependent, and find engineering solutions to mitigate/reduce the transmission of diseases.

The tenure of the Committee is till June 2022, and further deliberations and discussions on fighting the pandemic are expected to take place in future meetings.



Report by Ms Alpa Sheth on Session on “Education for a Smart Society”. The three speakers in the session were from diverse backgrounds. One of them was an innovator of children’s online learning software, another was from a national academy of technical sciences. The talk by one of the speakers, Dr. Jian Wang, Chairman, Alibaba Group Technology was impressive as has been a psychology professor for over ten years, a researcher at Microsoft Research Asia before joining Alibaba Group and rising to be its Chief Technology Officer and is currently involved in non-profit research. It is this eclectic career path that has given him the ability to frame things differently. He is also a compelling example of the case to be made that a good technological solution lies in the realm of a marriage of technology with humanities. It gives us the ability to frame issues differently - to ask different questions. Innovation happens with an out-of-box approach, with a new way of looking - which perhaps is not taught in engineering colleges.

His main thrust was that the current education has not and perhaps cannot catch up with what is happening out there in the world in real time. The current pace of growth and development requires a multidisciplinary approach while we still work in silos in engineering colleges. He also further mentioned that a non-profit organisation (which he is presently involved in- The City Brain Initiative) gives you the space and freedom to look at issues very differently.

Report by Prof Kamala Krithivasan on “CAETS Diversity Working Group”. About 15 persons participated from different countries. Initially each person was given a minute or two for introduction and later about 5 minutes to mention about the activities of their academy. The following were mentioned about INAE:

1. Women are being given more and more importance.
2. More nominations are sought after for fellowship and other awards from women.
3. This year 6 women were elected as fellows and also a foreign fellow.
4. On the whole, the fellows elected were from different age groups.
5. Women Engineer award was constituted and this year 3 women have been selected for the award, one from the academia, one from R&D, and one from industry.
6. Women Fellows are made members of many committees to encourage their active participation and contribution.

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, 2020.

Newly elected Fellows

Engineering Section-I (Civil Engineering)



- 1 **Prof. MM Ghangrekar**, Institute Chair Professor, Professor, Department of Civil Engineering, Head, School of Environmental Science and Engineering, Head, PK Sinha Centre for Bioenergy and Renewables, Professor In-charge, Aditya Choubey Centre for Re-water Research, Indian Institute of Technology, Kharagpur, Department of Civil Engineering, Indian Institute of Technology Kharagpur, Kharagpur



- 2 **Prof. CSP Ojha**, Institute Chair Professor, Civil Engineering Department, Indian Institute of Technology Roorkee, Uttarakhand



- 3 **Dr. N Subramanian**, Consulting Engineer; Former Proprietor and Chief Executive, Computer Design Consultants, Chennai

Engineering Section-II (Computer Engineering & Information Technology)



- 1 **Prof. Naveen Garg**, Janaki and KA Iyer Chair Professor, Department of Computer Science and Engineering, Indian Institute of Technology Delhi, New Delhi.



- 2 **Prof. Sudip Misra**, Professor, Department of Computer Science & Engg., Indian Institute of Technology Kharagpur, Kharagpur.



- 3 **Dr. HM Vin**, TCS Fellow & Chief Services Innovation Officer, Tata Research Development & Design Center, Tata Consultancy Services, Pune.



- 4 **Dr. Suparna Bhattacharya**, Distinguished Technologist, Hewlett Packard Enterprise, Bangalore.

Engineering Section-III (Mechanical Engineering)



- 1 **Dr. Pramod Kumar**, Associate Professor, Department of Mechanical Engineering, Indian Institute of Science, Bangalore.



- 2 **Prof. Amitava Datta**, Professor, Department of Power Engineering, Jadavpur University, Kolkata.



- 3 **Prof. S Paul**, Professor (HAG), Department of Mechanical Engineering, Indian Institute of Technology Kharagpur, West Bengal.



- 4 **Dr. R Balasubramaniam**, Head, Design & Manufacturing Section, CSDD, Bhabha Atomic Research Centre, Mumbai.

Engineering Section-IV (Chemical Engineering)



- 1 **Prof. KK Pant**, Petrotech Chair Professor and Head, Dept of Chemical Engineering, IIT Delhi, Joint Faculty, CRDT, IIT Delhi, Adjunct Professor, University of Saskatchewan, Canada, Honorary Faculty, University of Queensland, Australia, Indian Institute of Technology, Delhi, New Delhi.



- 2 **Prof. P Subramaniam**, Institute Chair Professor, Department of Chemical Engineering, Indian Institute of Technology, Madras, Chennai.



- 3 **Dr. JS Raut**, General Manager – Unilever Research & Development Bangalore, Bangalore.

Engineering Section-V (Electrical Engineering)



- 1 **Prof. Anil Kulkarni**, Professor, Department of Electrical Engineering, Indian Institute of Technology Bombay, Mumbai.



- 2 **Prof. L. Umanand**, Professor, Department of Electronic Systems Engineering, Indian Institute of Science, Bangalore.



- 3 **Prof. IN Kar**, Professor, Department of Electrical Engineering, Indian Institute of Technology Delhi, New Delhi.



- 4 **Dr. AP Tiwari**, Associate Director, KMG, BARC and Senior Professor (Engineering Sciences), HBNI, Knowledge Management Group, Bhabha Atomic Research Centre (BARC), Mumbai.

Engineering Section-VI (Electronics & Communication Engineering)



- 1 **Prof. MV Kartikeyan**, Professor, Department of Electrical Engineering, Indian Institute of Technology Tirupati.



- 2 **Prof. M Shojaei Baghini**, Professor, TATA Trust Chair Prof. in Frugal Engineering (2020-2023), Department of Electrical Engineering, Indian Institute of Technology Bombay, Mumbai.



- 3 **Prof. Jayadeva**, Microsoft Chair Professor, Department of Electrical Engineering, Indian Institute of Technology Delhi, New Delhi.



- 4 **Dr. C Kumar**, Scientist/ Engineer-'SG', Communication Systems Group, U R Rao Satellite Centre, Bangalore.



- 5 **Dr. CP Ravikumar**, Director of Technical Talent Development, Texas Instruments (India), Bangalore.

Engineering Section-VII (Aerospace Engineering)



- 1 **Mr. MS Suresh**, Associate Director, LPSC/ISRO & Project Director, SPSP, LPSC/ISRO, Valiamala.



- 2 **Dr. VRLalithambika**, Distinguished Scientist and Director, Directorate of Human Space Programme, Bangalore.



- 3 **Dr. Samikkanu Raja**, Chief Scientist and Professor (AcSIR) and Head, Structural Technological Division (STTD), CSIR-National Aerospace Laboratories, HAL, Bangalore.

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



- 1 **Prof UV Waghmare**, Professor, Theoretical Science Unit, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore.



- 2 **Dr G Padmanabham**, Director, International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI), Hyderabad.



- 3 **Dr. Harish C Barshilia**, Chief Scientist and Head, Surface Engineering Division, CSIR-National Aerospace Laboratories, Bangalore.



- 4 **Dr. Dinesh Srivastava**, Distinguished Scientist, Chairman, NFC Board & Chief Executive, Nuclear Fuel Complex, Hyderabad.

Engineering Section-IX (Energy Engineering)



- 1 **Dr. S Basu**, Director, CSIR-Institute of Minerals & Materials Technology, Bhubaneswar and Professor of Chemical Engineering, IIT Delhi, CSIR-Institute of Minerals & Materials Technology, Bhubaneswar.



- 2 **Dr. AK Nayak**, Outstanding Scientist, RED, Bhabha Atomic Research Centre, Mumbai.



- 3 **Dr. Anuradda Ganesh**, Chief Technical Advisor and Director, Cummins Technical Centre India (CTCI), Pune.

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



- 1 **Prof. Soumyo Mukherji**, Professor, Department of Biosciences and Bioengineering, Indian Institute of Technology Bombay, Mumbai.



- 2 **Prof. SK Pal**, Senior Professor, Department of Chemical, Biological and Macromolecular Sciences, S. N. Bose National Centre for Basic Sciences, Kolkata.



- 3 **Prof. Ambarish Ghosh**, Associate Professor, Centre for Nano Science and Engineering (CeNSE), Indian Institute of Science, Bangalore.

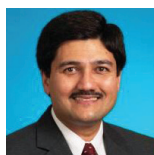


- 4 **Dr. S. Mande**, Distinguished Chief Scientist, TCS Research, Tata Consultancy Services Ltd. (TCS New Delhi.



- 5 **Dr. SSV Ramakumar**, Director (R&D), Indian Oil Corporation Ltd., Faridabad.

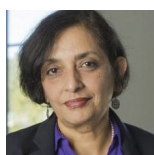
Newly elected Foreign Fellows



- 1 **Prof Nemkumar (Nemy) Banthia**, Professor and Senior Canada Research Chair , CEME University of Columbia, Canada.



- 2 **Prof Jyotirmoy Mazumder**, Robert H Lurie Professor of Engineering, Mechanical Engineering, Materials Science and Engineering, Director, Center for Laser Aided Intelligent Manufacturing, University of Michigan Michigan.



- 3 **Prof Jayathi Y Murthy**, Dean, Samueli School of Engineering, Distinguished Professor, Department of Mechanical Engineering, University of California, USA.



- 4 **Prof Nicholas A Peppas**, Cockrell Family Distinguished Regents Chair in Engineering, Professor, McKetta Department of Chemical Engineering, Professor, Department of Biomedical Engineering, Professor, Department of Pediatrics, Surgery and Perioperative Care, Dell Medical School and Professor, Division of Molecular Pharmaceutics and Drug Delivery, College of Pharmacy, Director, Institute for Biomaterials, Drug Delivery and Regenerative Medicine, The University of Texas, Austin.



- 5 **Prof Chanan Singh**, Regents Professor and Irma Runyon Chair Professor, Department of Electrical & Computer Engineering, USA.



- 6 **Mr Bipin V Vora**, UOP/Honeywell Fellow (Retired), Adjunct Professor, Dept. of Biological and Chemical Engineering, IIT-Chicago, USA.

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 under the Rule 37(g) in a year since 2016.

This year, two eminent engineering luminaries elected from Industry category under Rule37(g) were.



- 1 **Mr. SK Roongta**, Chairman, Bharat Aluminium Co. Ltd. (BALCO), Gurugram.



- 2 **Dr. Ravindra Dattatraya Kulkarni**, Managing Director, Elkay /chemicals Pvt. Ltd., Pune.

Honours and Awards

The details of awards received by INAE Fellows during the year are given below.

1	<p>Dr. B N Suresh, FNAE, Chancellor of Indian Institute of Space Science and Technology and Dr. K Sivan, FNAE, Secretary DOS / Chairman of ISRO were honoured with the prestigious 2020 'IEEE Simon Ramo Medal' for their outstanding leadership in developing national space program of India and for pioneering space technology. This award is for their exemplary work in the field of systems engineering. The award consists of a medal, citation, and a cash prize. The ceremony was held on September 29, 2020, at ISRO headquarters in Bengaluru.</p> <p>The ceremony was attended by Padma Vibhushan Dr. VK Aatre, former Chairman of DRDO; Padma Shri R.M. Vasagam former Project Director, APPLE Satellite; Dr. Surendra Pal, FNAE, former Vice Chancellor, Defence Institute of Advanced Technology Pune; Prof. H P Kincha, Chairman-Karnataka State Innovation Council; Prof. Govindan Rangarajan, Director of IISc; Prof. Anurag Kumar, FNAE former Director IISc; Prof. Dr. Ramakrishna Kappagantu, former IEEE Region 10 Director; Prof. Debabrata Das, IIITB; Prof. Radhakanth Padhi, IISc; Mr. Puneet Kumar, Chair- IEEE Bangalore Section and Secretary IEEE India Council and Mr. Harish Mysore, Sr. Director-IEEE India Operations and other ISRO dignitaries.</p> <p>The IEEE Simon Ramo Medal was established by the IEEE Board of Directors in 1982. It is named in the honour of the distinguished engineering contributions of Dr. Simon Ramo, former Vice Chairman of the Board and Chairman of the Executive Committee of Thompson Ramo Wooldridge (TRW), Inc. Dr B N Suresh and Dr. K Sivan are the only Indian recipients of this prestigious award till date.</p>
2	<p>Prof. Sankar K. Pal, FNAE, Distinguished Scientist and Former Director, Indian Statistical Institute (ISI), Calcutta, currently holding the position of INSA Distinguished Professorial Chair, has been selected as a National Science Chair (NSC), Government of India. The selection of this prestigious award is announced by the Science and Engineering Research Board (SERB), Department of Science and Technology (DST), Govt. of India. He would like to assume the office of this new position from August 1, 2020.</p>
3	<p>Prof. (Dr.) T.C. Rao, FNAE, Formerly, Director, Regional Research Laboratory (CSIR), Bhopal, formerly Head, Dept. of Fuel and Mineral Engineering, ISM Dhanbad has been chosen to head a Committee constituted by Ministry of Mines to prepare a holistic Vision Plan for the mineral sector including characterization, beneficiation, end-use and recycling, keeping in mind the economic viability and economic importance of minerals for the country.</p>
4	<p>Dr RK Bhandari, FNAE, Formerly Director, Central Building Research Institute, Roorkee & Programme Director, UN-HABITAT, Nairobi; Formerly Chairman, Centre for Disaster Mitigation and Management, VIT, Vellore is the winner of the Subhash Chandra Bose Aapda Prabandhan Puraskar 2021 Award in the field of Disaster Management. Government of India instituted the annual award known as Subhash Chandra Bose Aapda Prabandhan Puraskar to recognize and honour the invaluable contribution and selfless service rendered by individuals and organizations in India in the field of Disaster Management. The award is announced every year on 23rd January, the birth anniversary of Netaji Subhash Chandra Bose. For the year 2021, (i) Sustainable Environment and Ecological Development Society (in the institutional category) and (ii) Dr. Rajendra Kumar Bhandari (in the Individual category) have been selected for the Subhash Chandra Bose Aapda Prabandhan Puraskar for their excellent work in Disaster Management.</p>
5	<p>Dr. J.C. Misra, Ph.D., D.Sc., FNASc., FNAE, FIMA (UK), FIThP, FRSM (London), FIET (UK); Adjunct Professor, Indian Institute of Engineering Science and Technology, Shibpur, Howrah; Formerly, Pro Vice-Chancellor, SOA University, Bhubaneswar; Former Professor and Head, Department of Mathematics, IIT Kharagpur; Ex- President, Mathematical Sciences Section, Indian Science Congress and Recipient of INAE Outstanding Teachers Award and Ram Mohan Puraskar has been elected as a of Fellow the Royal Society of Biology (London) on 1 April 2020 in recognition of his research contributions in Physiological Fluid Dynamics.</p>

News of Fellows

- 1 Dr. Sanak Mishra, FNAE, President, INAE and formerly Managing Director, Rourkela Steel Plant and formerly Director, Steel Authority of India Ltd (SAIL); formerly Vice-President, ArcelorMittal and CEO India Projects; formerly Secretary General, Indian Steel Association and former President, Indian Institute of Metals has recently authored a book “Sanak Mishra - An Autobiography” published by Notion Press. In 294 pages, the book narrates his personal and professional life over 70 years, from the age of four to the age of seventy-four.

The review of the book as mentioned in the back cover page of the book is reproduced below.

“This is an autobiography that traces the life of a transformational leader, as narrated by him. It alternates between his personal life and his professional life, his aspirations, and his accomplishments as a scientist, as an industry captain and as a communicator. Above, all the book is about people and what makes them what they are. It details how his concept of reducing ‘the distance between minds’ helped synergise twenty-six thousand employees of one of the largest industrial enterprises in India, leading to its regeneration and sustainability. The narration is full of subtle elements which will be motivational to many, especially the young.”

- 2 Dr Sanak Mishra, FNAE, President, INAE and 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 has been selected as a member of the Jury panel for GITA Global Innovation Excellence Awards by the Global Innovation & Technology Alliance (GITA). The GITA Global Innovation Excellence Award was instituted with the objective of recognizing Companies who have developed path breaking technologies through global partnerships with industry and academia, contributing to a path leading to self-sustenance and development.

Dr Sanak Mishra has also been nominated as Member of the Research Council (RC) for the CSIR- National Physical Laboratory (CSIR-NPL), New Delhi constituted with the objective of providing advice on the formulation of R&D programmes and future directions of activities of the laboratory keeping in view the CSIR mandate, national priorities and opportunity areas.

- 3 Prof. SN Upadhyay, FNAE, Department of Chemical Engineering & Technology, IIT (BHU) Varanasi has co-authored a book titled “Industrial Enzymes for Biofuel Production” published by Elsevier Press. The hard copies of the book will be published shortly. He has also written a book on “Fluidization: A General Introduction” (तरलन: एक सामान्य परिचय) for diploma students of Chem Eng./Mech. Eng./Civil Eng./Env. Eng. and Agricultural Engineering studying in polytechnics of Hindi belt states.

- 4 Dr MD Nair, FNAE, Formerly Vice President, SPIC Pharmaceuticals, Madras has authored a book titled “Fifty Years in The Indian Pharmaceutical Industry” which was released by MOS, GOI Shri Alphons Kannanthanam in Kochi in March 2019.

- 5 The Digital Twin methodology has been applied for modeling, analysis & projections for the COVID 19 scenario in Pune, by Dr. Vinay Kulkarni, FNAE, Chief Scientist, Tata Research Development and Design Centre, Tata Consultancy Services Research, Hadapsar, Pune along with his team at TRDDC-TCS. It has been successfully used by PMC. INAE had covered the subject of Digital Twins in the first of its webinar series. Dr. Vinay Kulkarni had delivered a talk on the subject. The recording is available on the INAE website (www.inae.in).

- 6 Dr Debabrata Das, FNAE, Visiting Professor, Former Head and Renewable Energy Chair Professor, Department of Biotechnology, Former Professor-in-Charge, P K Sinha Centre for Bioenergy, Indian Institute of Technology, Kharagpur has co-authored a new book titled “Biochemical Engineering: A Laboratory Manual” with Dr Debayan Das which will be published by M/s. Jenny Stanford Publishing, Singapore in the winter, 2020. This book will be marketed by M/s. Taylor & Francis. The authors hope that this book will be very useful to the undergraduate/postgraduate students in Biotechnology / Biochemical Engineering / Chemical Engineering / Applied microbiology / Environmental Biotechnology.

Dr. Das co-authored a new book titled “Industrial Biotechnology” which will be published by M/s. Taylor & Francis, USA early 2021. He hopes that this book will be extremely useful to the undergraduate/postgraduate students in Biotechnology / Biochemical Engineering / Chemical Engineering / Applied microbiology / Environmental Biotechnology.

- 7 Prof Prem Vrat, FNAE, Former Founder Director, IIT Roorkee; Former VC, UPTU, Lucknow; Former Professor & Director-in-Charge, IIT Delhi; Former Vice-Chancellor and Professor of Eminence, ITM University, Gurgaon has been nominated as the Chairperson of the Board of Governors (BoG) of Indian Institute of Technology (Indian School of Mines) Dhanbad by the Hon’ble President of India, in his capacity as the Visitor of the Indian Institute of Technology (ISM) Dhanbad (Jharkhand) for a period of three years w.e.f. 25.08.2020.

- 8 Dr U Kamachi Mudali, FNAE, formerly Distinguished Scientist and Chairman & Chief Executive, Heavy Water Board, Department of Atomic Energy, Mumbai and Former Director, Materials Chemistry and Metal Fuel Cycle Group, IGCAR, Kalpakkam & Former Associate Director, Corrosion Science & Technology Group and Materials Process & Equipment Development Group, IGCAR, Kalpakkam was felicitated for his 36 years of dedicated service towards nuclear industry and corrosion control technologies by his friends, colleagues and students on September 29, 2020, over WebEx. The programme was attended by about 270 colleagues/students/associates of Dr U Kamachi Mudali. Dr Anil Kakodkar, FNAE was the Chief Guest and he officially released the e-book entitled “A Treatise on Corrosion Science, Engineering and Technology” a commemorative volume brought out in honour of Dr U Kamachi Mudali. The e-copy of the book may be downloaded from the link given below.

https://1drv.ms/b/s!AiJosityWbm3iM1VuaQvbrbbKAR0_Q?e=CZD4We

- 9 Prof Sameer Khandekar, FNAE and Prof K Muralidhar, FNAE of IIT Kanpur have authored a new book entitled “Drop Dynamics and Dropwise Condensation on Textured Surfaces” published by Springer Nature as a part of the Mechanical Engineering Series of Advanced Texts.

The book announcement can be seen by clicking on the link given below:
<https://www.springer.com/gp/book/9783030484606>

- 10 Prof Suresh K Bhargava, FNAE, Dean- R & I (India), STEM College, RMIT University was the only elected fellow of AAAS from Australia in 2020. Nearly 500 members of the American Association for the Advancement of Science have earned the lifetime distinction of AAAS Fellow. AAAS Fellows are elected each year by their peers serving on the Council of AAAS, the organization’s member-run governing body. The title recognizes important contributions to STEM disciplines, including pioneering research, leadership within a given field, teaching and mentoring, fostering collaborations, and advancing public understanding of science. A virtual induction ceremony for the 489 newly elected Fellows took place on February 13, 2021, the Saturday following the AAAS Annual Meeting. The honourees received official certificates and rosette pins in gold and blue, colours symbolizing science and engineering, by mail.

11	<p>Prof N Viswanadham, FNAE, Emeritus Professor & INSA Honorary Scientist, Computer Science and Automation, Indian Institute of Science, Bangalore has authored a paper on a subject of topical interest viz” Orchestrating the World’s Largest Covid-19 Vaccinations in India”.</p> <p>He has also delivered a talk which is uploaded on YouTube and can be viewed by clicking on the link given below.</p> <p>https://youtu.be/Ujf5f18SX0k</p>
12	<p>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, UP has authored a paper abstract on “Waste Heat and Waste Sources for Renewable Energy in Prevention of Pollution” which was accepted for poster presentation in 36th ICSWTM 2021 held in Annapolis, MD, Washington DC, USA in March 2021.</p> <p>Prof SN Mukhopadhyay also delivered a lecture as an invited online speaker in ICRM 2020, on December 13, 2020 at MGU, Kottayam, Kerala, on “Recycling of LHGBRs Wastes for Renewable Energy and Prevention of Pollution”. In addition, in a session on Polymer Recycling on the same day he was an invited Chairperson in the event.</p> <p>Prof. SN Mukhopadhyay was also invited to submit abstract in ICSWTM 2021 Conference held on March 14-16, 2021. The abstract on “Waste Heat and Waste Sources for Renewable Energy in Prevention of Pollution” was accepted and he delivered on line talk in this Virtual Conference of Widener University, Washington DC, USA.</p>
13	<p>Mr VK Agarwal, FNAE, Formerly Chairman, Railway Board & Ex-officio Principal Secretary, Govt. of India after studying a wide spectrum of subjects ranging from highly scientific / technical areas to social, economic, financial, philosophical, meta-physical and religious areas has prepared a list/ dictionary of Words, Terms & Abbreviations through a process of systematic compilation which runs into 587 Pages / 7844 Items.</p> <p>He has also authored an IEI Centenary Monograph on ‘Survival of Planet Earth: Scientifico-Spiritual Analysis’, published under the aegis of Interdisciplinary Engineering.</p> <p>The monograph may be accessed using the link:</p> <p>https://www.ieindia.org/webui/ajax/Downloads/WebUI_PDF/Publication/Monograph.pdf?v.20210204.1</p> <p>Mr VK Agarwal is author of one of the lead articles on “Role of Engineers in Policy Making” in IEI Centenary Book titled “Engineering for the Future”.</p>
14	<p>Dr BVA Rao, FNAE, Professor (Retd), IIT Madras; Former Pro-Chancellor, VITU Vellore and Adjunct Professor, NIAS, Bangalore has published four Volumes of his lectures/talks at various Forums and Seminars relating to “Higher Education in Engineering and Technology - Current and Futuristic Strategies” collated over a period of time. Each of these volumes related to some specific aspects needed for improving our system to meet global challenges in Higher Education.</p>
15	<p>Dr RK Bhandari, FNAE, Formerly Director, Central Building Research Institute, Roorkee & Programme Director, UN-HABITAT, Nairobi; Formerly Chairman, Centre for Disaster Mitigation and Management, VIT, Vellore Participated in A Webinar as Expert of The Day, Organized by National Institute of Disaster Management (NIDM), Ministry of Home Affairs, Govt. of India on “Risk to Resilience: A Dialogue with Dr RK Bhandari” on February 16, 2021.</p>
16	<p>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, on invitation sent abstract of his invited lecture on title “In vitro, in situ, in vivo and de novo Membrane Assisted Bioprocesses” which was accepted to be delivered in ICMMAP-2021 held between February 12 to 14, 2021 in MGU, Kottayam, Kerala.</p> <p>His paper titled “Food Packaging: Fundamentals and Advances” was accepted by Journal of Food Science and Engineering. Also, he had delivered IL54 in ICMMAP 2021 on 13th February 2021 which was held in MGU, Kottayam, Kerala</p>

- 17 Dr U Kamachi Mudali, FNAE, formerly Distinguished Scientist and Chairman & Chief Executive, Heavy Water Board, Department of Atomic Energy, Mumbai has recently assumed the position of Vice-Chancellor of VIT Bhopal for three years.
- 18 A paper by Prof. Saptarshi Basu, FNAE, DRDO Chair Professor in Mechanical Engineering, Indian Institute of Science, Bangalore titled “On secondary atomization and blockage of surrogate cough droplets in single- and multilayer face masks “ is now online in SCIENCE ADVANCE.
The paper can be viewed at the link given below
<https://advances.sciencemag.org/content/7/10/eabf0452/tab-pdf>
The Press Release can be viewed at the link given below.
<https://www.iisc.ac.in/events/multilayer-masks-most-effective-at-preventing-aerosol-generation/>

News of INAE Young Associates

- 1 Dr Amol A Kulkarni, Scientist, National Chemical Laboratory (NCL), Pune and Associate Editor, Transactions of Indian National Academy of Engineering - An International Journal of Engineering and Technology, was awarded the Shanti Swarup Bhatnagar Prize for the year 2020 in Engineering Sciences Category.



Fellows Deceased in Last one Year

During the year 2020-21, 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

Mr Rakesh Bakshi

(June 4, 1958 -April 13, 2020)

Mr Rakesh Bakshi, FNAE born on June 4, 1958 passed away on April 13, 2020.

Mr Rakesh Bakshi, FNAE, CMD RRB Energy Ltd, New Delhi had made significant contributions to the development of Wind Energy Systems and was one of the pioneering entrepreneurs in the field of non-conventional energy sources in the country. He had successfully promoted and implemented advanced climate friendly technologies past the demonstration phase, more particularly by converting renewable sources of energy into heat and power. He was dedicated in his efforts in setting up companies to research, manufacture and implement renewable power plants. Mr Bakshi was responsible for introducing some of the most advanced technologies in the field of wind power energy in the Indian energy sector. He is acknowledged as a pioneer in the field of non-conventional energy sources in India, having contributed extensively to harnessing and promoting renewables for everyday energy needs. Mr Rakesh Bakshi was conferred the Padma Shri by the President of India in recognition of his commendable contributions in the field of renewable energy sources.

May God bless his soul to Rest in Peace

Prof PN Murthy

(April 23, 1928- June 23, 2020)

Prof PN Murthy, FNAE born on April 23, 1928 passed away on June 23, 2020.

Prof PN Murthy, Formerly Adviser, Tata Consultancy Services, Hyderabad had made significant research contributions in the areas of aircraft structures and sandwich beams. He taught Aeronautical Engineering at Indian Institute of Science, Bangalore and was the head of the Department of Aeronautical Engineering in IIT Kanpur. Later, he moved to Tata Consultancy Services to start and head a research centre in Systems Engineering and Cybernetics at Hyderabad and subsequently assumed the responsibility of Advisor. He was engaged in the system design of projects and cybernetic analyses of decision-making models and was principal initiator in promoting an Adult Literacy Program through a Computer Based Functional Literacy (CBFL) solution.

May God bless his soul to Rest in Peace

Prof DK Dutta Majumder

(February 10, 1932 – June 27, 2020)

Prof DK Dutta Majumder, FNAE born on February 10, 1932 passed away on June 27, 2020.

Prof DK Dutta Majumder, Professor Emeritus, Electronics and Communication Sciences, Indian Statistical Institute, Kolkata had made pioneering contributions in computer memory technology, pattern recognition, speech recognition, image processing and fuzzy systems, among others. He played an instrumental role in initiating Computer Science Education and Research in India. The then Department of Electronics, Government of India established one of the nation's Fifth Generation Computer System (FGCS) Research Centres at ISI Kolkata under his leadership in 1986. Prof. Dutta Majumder was conferred the INAE Life Time Contribution Award in Engineering in the year 2004.

May God bless his soul to Rest in Peace

Prof JS Rao
(July 1, 1939 - July 4, 2020)

Prof JS Rao, FNAE born on July 1, 1939 passed away on July 4, 2020.

Prof JS Rao, Formerly Science Councillor, Embassy of India, Washington D.C. and Professor, IIT Delhi; Formerly Chief Technology Officer, Quality Engineering and Software Technologies Pvt. Ltd., Bangalore; Former President-Academics, Kumaraguru College of Technology, Coimbatore & Chief Science Officer, Altair Engineering (India) Bangalore had made significant research contributions in the areas of vibrations, rotor dynamics and design and theory of machines. He had a long and distinguished tenure at IIT Delhi of nearly three decades and had published more than 300 research papers and books on the subject of vibrations, as an expert in the field.

May God bless his soul to Rest in Peace

Prof NN Som
(January 29, 1941 – July 31, 2020)

Prof NN Som, FNAE born on passed away on January 29, 1941 passed away on July 31, 2020.

Prof NN Som, Formerly Professor, Department of Civil Engineering, Jadavpur University, Kolkata had made significant contributions in Education in the areas of Civil Engineering and Geotechnical Engineering. His contributions in many of the flagship projects such as Kolkata Metro, Delhi Metro, and the Golden Quadrilateral project are exemplary. His research work in the fields of Foundation, Highway and Geo-environment engineering in general and in the areas of Quality Geotechnical Investigation, Slope stability, Ground Improvement, and Underground construction in particular is well -cited. He served as a consultant to many industrial organizations and public bodies like ONGC, IOCL, BPCL and Indian Railways etc.

May God bless his soul to rest in peace

Dr Sekhar Basu
(September 20, 1952 – September 24, 2020)

Dr Sekhar Basu, FNAE born on September 20, 1952 passed away on September 24, 2020.

Dr Sekhar Basu, Former Director, Bhabha Atomic Research Centre, Mumbai and Former Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy, Mumbai had made significant contributions in the field of Nuclear Engineering thereby providing a boost to the Indian Nuclear Power programme. He had been proactively engaged in the design, development, construction and operation of nuclear recycle plants at Tarapur and Kalpakkam involving reprocessing and nuclear waste management. He also made crucial contributions to the development of special designs for reactor safety systems and shielding and radiation protection systems for nuclear power plants in the country. Dr Sekhar Basu received several awards and honours including the Padma Shri by President of India.

May God bless his soul to rest in peace

Dr PL Narasimhan
(August 13, 1940 – October 1, 2020)

Dr PL Narasimhan, FNAE, born on August 13, 1940 passed away on October 1, 2020.

Dr PL Narasimhan, FNAE, TVS Motors Chair Professor, Department of Industrial Engineering and Management, Indian Institute of Technology Kharagpur was Formerly Vice-President (R&D), Lakshmi Machine Works Ltd wherein he made significant contributions in collaborative new product development with a view to build up the technological base to bring competitive and state-of-art textile machineries to compete in the market. The development of these



machines required in-depth knowledge of Mechanical engineering, textile Engineering, Metallurgy, Pneumatics and electronics etc. At IIT Kharagpur, Dr PL Narasimhan motivated the final year BTech students to creative ideas and was innovative in his teaching methods.

May God bless his soul to rest in peace

Prof AK De

(November 2, 1925 -October 30, 2020)

Prof AK De, FNAE born on November 2, 1925 passed away on October 30, 2020.

Prof AK De, FNAE former Director, IIT Bombay and former Chairman, AERB had made significant research contributions in the field of Mechanical Engineering and as an educationist and institution builder. He had the distinction of being the first Chairman of the Atomic Energy Regulatory Board (AERB) and during his tenure several codes of practices were issued and guides and standards were prepared for the safe functioning of nuclear installations and radiation facilities. He also served as Director of the Central Mechanical Engineering Research Institute, Durgapur. As Director, IIT Bombay he was recognized for establishment of Post-Graduate Programs and for reforms to enhance the quality of education.

May God bless his soul to rest in peace

Dr FC Kohli

(February 28, 1924 – November 26, 2020)

Dr FC Kohli, FNAE born on February 28, 1924 passed away on November 26, 2020.

Dr FC Kohli, FNAE was founder and first CEO of Tata Consultancy Services (TCS) and also served as Deputy Chairman of TCS. He made outstanding contributions as an exceptionally talented engineer, an institution builder, a mentor par excellence and a visionary, and devoted his whole life to the cause of Indian engineering education, research and industry. He was very appropriately called the father of Indian IT industry as he helped create an industry which has grown to become a globally recognized business success story from India and contributes significantly to the Indian economy. For his pioneering efforts on engineering education, research and his outstanding contributions to the industry, he was honoured both in India and abroad including being conferred the Padma Bhushan by the President of India in the year 2002. He was the proud recipient of the IEEE Founders Medal (2012) and the INAE Lifetime Contribution Award in Engineering (2000).

May God bless his soul to rest in peace

Maj Gen JC Ahluwalia (Retd)

(July 7, 1927- November 30, 2020)

Maj Gen JC Ahluwalia, FNAE born July 7, 1927 passed away on November 30, 2020.

Maj Gen JC Ahluwalia (Retd) served in the Indian Army for over thirty years where he was commandant of an Army Base Workshop responsible for repair and overhaul of Electronics, Radar and Missile Guided and Power equipment. As the Managing Director of the Gujarat Communication and Electronics Ltd (GCEL), Baroda his significant contributions were to provide U-matic Colour Video Cassette Recorders, Edit Control units and cameras for Doordarshan in electronics news gathering and field production for the first time in India for colour broadcasts during ASIAD in 1982. Maj Gen JC Ahluwalia (Retd) made significant and dedicated contributions while serving as Executive Secretary, INAE and later as Adviser, INAE.

May God bless his soul to Rest in Peace

Prof Roddam Narasimha
(July 20, 1933 – December 14, 2020)

Prof Roddam Narasimha, FNAE born on July 20, 1933 passed away on December 14, 2020.

Prof Roddam Narasimha, Formerly Director, NAL, Bangalore and Formerly Director, National Institute of Advanced Studies, Bangalore had made significant contributions to some of India's major scientific programmes, including the Indian Space Research Organisation and the Light Combat Aircraft Programme. Prof Narasimha, as a member of several high level advisory committees of the Govt. of India (National Security Advisory Board and the Scientific Advisory Committee to the Prime Minister and Cabinet, Member of the Space Commission etc) and as a distinguished academic, policy maker and administrator had hugely contributed to the promotion of the practice of engineering & technology and the related sciences, particularly in the field of aerospace and atmospheric sciences, and their application to solving problems of national importance. He had also provided valuable inputs for the promotion of aerospace technologies, aerospace education, aerospace R&D and industry in the country. Prof Roddam Narasimha was a recipient of several awards and honours including INAE Life Time Contribution Award in Engineering and Padma Bhushan in 1987 and Padma Vibhushan in 2013 by President of India.

May God bless his soul to Rest in Peace

Prof. D.K. Paul
(May 28, 1947 to December 27, 2020)

Prof DK Paul born on May 28, 1947 passed away on December 27, 2020.

Prof DK Paul, Earthquake Engineering Consultant, Department of Earthquake Engineering, Indian Institute of Technology, Roorkee had made significant contributions in the design of earthquake safe construction of structures, especially, buildings and dams. He contributed significantly to uplifting the level of Earthquake Engineering courses run by the Ministry of Human Resource Development and Earthquake Risk Management programs run by the Ministry of Home Affairs. His contributions in the area of standardization of Earthquake Resistant Design are well recognized.

May God bless his soul to Rest in Peace

Prof DS Varma
(July 31, 1934 - January 27, 2021)

Prof DS Varma born on July 31, 1934 passed away on January 27, 2021.

Prof DS Varma, Formerly Director, North Eastern Regional Institute of Science and Technology (NERIST), Itanagar and Formerly, Professor of Textile Engineering, IIT Delhi had made significant research contributions in the areas of Textile Engineering and Polymer Science including understanding the structure-property relationships in polymeric and fibrous materials. His research work in the area of polymer blends and fibre reinforced composites including fabrication of hybrid composites with improved shear properties is well recognized. His research work has significance in the field of low temperature manufacture of Polyacrylonitrile (PAN)-based carbon fibres.

May God Bless His Soul to Rest in Peace



Dr Narayanan Lakshmanan
(12 November 1946 – 2 February 2021)

Dr N Lakshmanan born on November 12, 1946 passed away on February 2, 2021.

Dr N Lakshmanan, Formerly Director, Structural Engineering Research Centre, CSIR, Chennai and Formerly Project Advisor, SERC, CSIR, Chennai had made significant research contributions in the area of Structural dynamics. He led the creation of State-of-the-Art world class test facilities viz. Structural Dynamics Laboratory; Tower Testing and Research Station; Fatigue Testing Laboratory; wind engineering laboratory; Advanced Seismic Test Facility, and construction of various other labs in SERC, Chennai. His studies on structures in cyclone prone areas are noteworthy.

May God Bless His Soul to Rest in Peace

Mr S Ramakrishnan
(June 2, 1949 – December 1, 2020)

Mr S Ramakrishnan, FNAE born on June 2, 1949 passed away on December 1, 2020.

Mr S Ramakrishnan, former Director of Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram had made significant contributions in the areas of Aerospace Propulsion and Launch Vehicle Engineering. He joined the VSSC, a lead centre of the Indian Space Research Organisation (ISRO), in August 1972. He was a member of the SLV-3 project team responsible for the development of India's first satellite launch vehicle. He then moved to the Polar Satellite Launch Vehicle (PSLV) project in 1983 and worked on liquid propulsion systems. He was also project director for the PSLV continuation programme, and later, mission director for the PSLV C1, C2, C3 and C4 flights. In 2003, he took over as Project Director, GSLV-Mk III. He became Director of the Liquid Propulsion Systems Centre (LPSC) in June 2010, and three years later, in 2013, he took over as VSSC Director. He received the Padma Shri by President of India in 2003.

May God Bless His Soul to Rest in Peace

INAE Annual Convention

INAE Annual Convention 2020

The INAE Annual Convention 2020 was held online during December 21-22, 2020, for the first time due to the unprecedented circumstances all over the world on account of COVID pandemic and the restrictions thereof which limited conduct of a physical Annual Convention. However, the programme was fairly like to that of the Annual Convention held every year. The Programme of the Annual Convention and the video recording of the Sessions were made available on INAE website.

The online Annual Convention was organized under guidance of Annual Convention Organizing Committee chaired by Dr. Pradip. The members of the Committee were Dr. Purnendu Ghosh, Prof. Indranil Manna, Prof Kota Bhanu Sankara Rao, Mr. K Ananth Krishnan, Mr. MV Kotwal, Prof. Subhasis Chaudhuri, Dr. Debashish Bhattacharjee and Lt Col Shobhit Rai (Retd). A registration site was developed to facilitate registration of Fellows, Young Associates, Awardees and Guests for the virtual convention. There were more than 450 registrations from INAE Fellows/ Foreign Fellows, Young Associates, awardees and delegates for the online INAE Annual Convention 2020.

The Inaugural session was held on December 21, 2020, at 10:30 AM which featured the lighting of the lamp by the dignitaries on the dais viz Dr Sanak Mishra, President, INAE; Prof Indranil Manna, Vice-President and President-Elect, INAE; Dr Purnendu Ghosh, Vice-President, INAE; Dr Pradip, Vice-President, INAE and Prof K Bhanu Sankara Rao, Chief Editor of Publications, INAE. This was followed by the delivery of the Presidential Address by Dr Sanak Mishra, President, INAE.

Dr Sanak Mishra then gave a brief introduction of the Chief Guest, Mr. TV Narendran, FNAE, CEO and Managing Director, Tata Steel Ltd and invited him to deliver the Inaugural Address. Mr TV Narendran delivered an enlightening address on the topic "Engineering Innovations in Industry". The Inaugural Session concluded with the Vote of Thanks proposed by Dr Pradip, Vice-President, INAE and Chairman, Annual Convention Organizing Committee.

After the Inaugural Session, a small Quiz was held for the delegates in which interesting questions on INAE were read out by the compere and answers were revealed after giving time for the delegates to submit their answers. The names of the delegates who answered the questions correctly were displayed at the end of the day after the Grand Award Function. The Grand Award function commenced at 2PM during which the various awards instituted by the Academy were conferred. In the first part of the Grand Award Function, the Life time Contribution Award in Engineering; Prof. Jai Krishna and Prof. SN Mitra Memorial Awards; Outstanding Teachers Award and Woman Engineer of the Year Award 2020 were conferred. The citations for the first part of the Grand Award Function were read out followed by acceptance speech by the awardees. The Life time Contribution Awards in Engineering 2020 were conferred on Prof KA Padmanabhan and Dr TSR Prasada Rao.



Prof KA Padmanabhan being conferred the Life Time Contribution Award in Engineering 2020 virtually



Dr TSR Prasada Rao being conferred the Life Time Contribution Award in Engineering 2020 virtually

Prof Jai Krishna Memorial Award 2020 was conferred on Dr V Ramaswamy and Prof SN Mitra Memorial Award 2020 was conferred on Prof LM Patnaik.



Dr V Ramaswamy being conferred Prof Jai Krishna Memorial Award 2020 virtually



Prof LM Patnaik being conferred Prof SN Mitra Memorial Award 2020 virtually

The Outstanding Teachers Awards 2020 were conferred on Prof Ranjit Kumar Ray and Prof Bhim Singh.

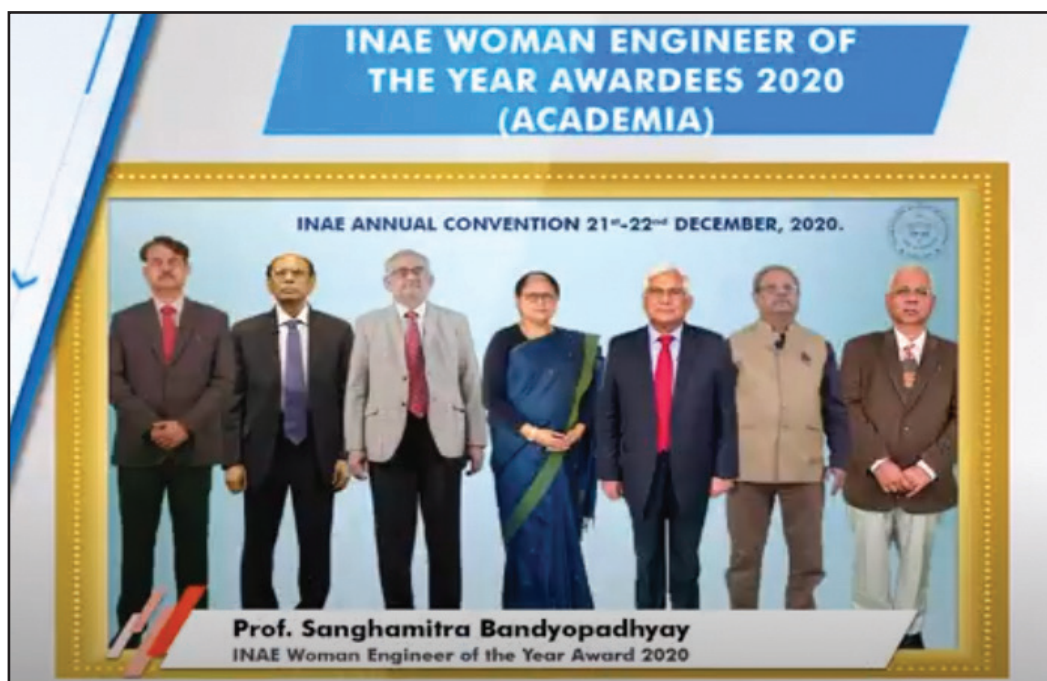


Prof Ranjit Kumar Ray being conferred the Outstanding Teachers Award 2020 virtually

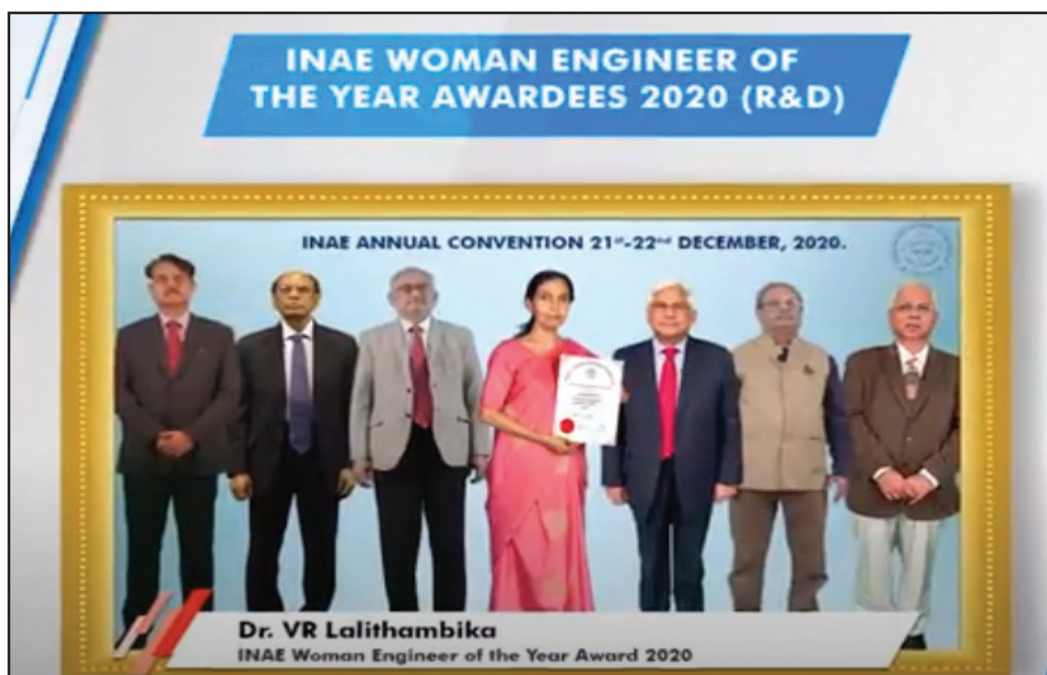


Prof Bhim Singh being conferred the Outstanding Teachers Award 2020 virtually

INAE had instituted the award in the year 2020 called “INAE Woman Engineer of the Year Award”. The purpose of the award is to recognize and honour our women engineers every year, who have made outstanding contributions to engineering/technology in India and who serve as role models to upcoming engineering professionals in the future. Three women engineers between the ages of 40 to 60 years, are to be awarded each year- one each from the three categories viz. Academia, R&D and Industry. Nominations were invited for the award this year and the first awardees selected for conferment of the award were Prof. Sanghamitra Bandyopadhyay in Academia category; Dr. Lalithambika VR in R&D category and Dr. Dheepa Srinivasan in Industry category.



Prof. Sanghamitra Bandyopadhyay being conferred the Woman Engineer of the Year Award 2020 virtually



Dr. Lalithambika VR being conferred the Woman Engineer of the Year Award 2020 virtually



Dr. Dheepa Srinivasan being conferred the Woman Engineer of the Year Award 2020 virtually

After the break, the Young Engineer Award, Young Entrepreneur Award and Innovative Student Projects Award were presented. Fifteen candidates were conferred the INAE Young Engineer Award 2020. INAE Young Entrepreneur Award was conferred on Mr. Akshay V Singhal and Dr. Anuya A Nisal and Special Commendation Certificate was given to Dr. Sundararajan Krishnan and Mr. Jayant Sitaram Karve. The Innovative Student Project Award 2020 was conferred on Ten nominees at Doctoral level; One individual Award and four shared Awards (Nine nominees) at Masters' Level and eight individual Awards and two shared Awards (Twelve Nominees) at Bachelor level.

Day 2 of the Annual Convention on December 22, 2020 commenced with the Induction Ceremony for newly elected Fellows/Foreign Fellows and Young Associates. At first the induction was carried out of the two eminent persons from Industry elected under Rule 37 (g) followed by induction of 38 newly elected Fellows and 6 Foreign Fellows. Fifteen Young Engineer Awardees were also inducted as Young Associates. In each case, the citations were read out and Dr Sanak Mishra, President, INAE inducted the Fellows/Young Associates into the fold of the Academy.

Subsequent to the Induction Ceremony, the Annual General Meeting (AGM) and Special General Meeting (SGM) of Fellows were held which was attended by 92 Fellows and Young Associates. During the AGM the revised composition of Governing Council, Sectional Committees and Other Committees/ Forums effective from January 1, 2021, were announced. A Brainstorming Session was held wherein suggestions/inputs were invited from the Fellows on issues of topical concern. During the SGM of Fellows the agenda items included amendment to rules as recommended by the Governing Council. The meetings ended with a vote of thanks to the outgoing President - Dr Sanak Mishra and welcoming of Prof Indranil Manna as the new President of INAE effective from January 1, 2021.

The INAE Annual Convention was a grand success and several messages/emails had been received praising the event a few of which are reproduced below.

- “My congratulations Dr Mishra and Team INAE for the wonderful way the Inaugural Session welcomed each Fellow to the Function. Lots of work and shows the Engineers perfection”
- “Very comprehensive Presidential Address”

- *“hearty congratulations to Dr Sanak Mishra, Dr BN Suresh, Dr PS Goel and all the past Presidents of INAE who have brought INAE to the current level of eminence.”*
- *“Hello everyone, greetings from Chicago. Very well organized”*
- *“Excellent”*
- *“A new experience- so well done”*
- *“Excellently done in COVID19 time”*
- *“Congrats for a well-organized inaugural function in the virtual mode.”*
- *“Congrats for an excellent digital display of the inaugural event”*
- *“I am excited and luckiest person to get an opportunity to be part of this function. The way technology usage has been conceptualized and video has been done is awesome”*
- *“Excellent conf & speeches with good connectivity.”*
- *“Extremely well organized event.”*
- *“Good evening from Austin, Texas. Congratulations to INAE. Extremely successful meeting. Very impressed with how this meeting is handled. Very high standards. Excellent. Bravo and warm wishes for the meeting”.*
- *“I am now enjoying the Inaugural season, and congratulations to you and Team INAE for the excellent and flawless start today.”*
- *“The inaugural session was a great success. It was like a clock-work. Congratulations to you and your team and Dr. Pradip and his colleagues, and also to Vaishali and Mayank, and the compere Juhi for her clear pronunciation of every single word.”*
- *“I found the session quite good and appealing. Compliments to everyone who has contributed.”*
- *“The ceremony is beautifully organised, and I am watching it with enjoyment.*
- *“Hearty Congratulations on a fabulous event today, that went with clockwork precision. Truly experienced “virtual reality” and what better organization than INAE to experiment with this, for the grand function.”*
- *“The Award Function was very grand though it is virtual.”*
- *“I thank the organizers for putting in lot of efforts to organize the virtual award ceremony”.*
- *“That was an excellently conducted event. Both days were handled extremely well and all events went like clockwork. My congratulations and best wishes.”*
- *“I attended INAE convention both the days on Dec.21 & 22. The event was very well organised. I wish to convey my congratulations to the President Dr. Sanak Mishra and the whole team who was responsible in organising the whole event so well.”*

INAE Webinar Series Programme subsequent to Annual Convention 2020

As part of the online INAE Annual Convention 2020, INAE conducted a special Webinar Series from January 4, 2021 to January 20, 2021 featuring technical lectures by awardees for the year 2020 of Life Time Contribution Award in Engineering, Prof Jai Krishna & Prof SN Mitra Memorial Awards, INAE Outstanding Teachers Award, INAE Woman Engineer of the Year Award, Young Entrepreneur Award, Innovative Student Projects Award at Doctoral Level, Young Engineer Award and Newly elected Fellows/ Foreign Fellows affiliated to ten Engineering Sections of INAE.



The presentations focused upon the technical contributions of newly elected Fellows and awardees which were followed by interactive Question and Answer session and summing up of presentations and concluding remarks by the Chairpersons. The Chairpersons comprised of President, INAE and former Presidents and Conveners of the ten Sectional Committees. There was active participation in the webinars and lectures were high in technical content and were found to be interesting for the Audience. There was a total of 77 presentations and about 600 participants in all. The details of various Sessions indicating the names of the speakers and the topics of the presentation made from 4th to 20th January 2021 during the INAE Webinar Series are given below.

January 4, 2021 (Monday)

Session on Award Lectures by Award Winners:

Session Chairperson: *Dr. PS Goel, Former President, INAE*

Life Time Contribution Award in Engineering

- Prof. KA Padmanabhan - On Some Boundless Excursions in Materials Science and Engineering
- Dr. TSR Prasada Rao - Research, Development, and Commercialisation: My Journey in Engineering

Prof Jai Krishna Memorial Award

Dr. V Ramaswamy - Modern Trends in the Usage of High Strength Steels

Prof SN Mitra Memorial Award

Prof. LM Patnaik - Joys of Initiating and Nurturing Research in Parallel Computing

January 5, 2021 (Tuesday)

Session on Award Lectures by Award Winners:

Session Chairperson: *Dr. BN Suresh, Past-President, INAE*

Outstanding Teacher Award

Prof. Ranjit Kumar Ray - My Tryst with 'Texture' for Five Decades

Prof. Bhim Singh - Solar Photovoltaic Power Generation and Its Impact on Our Lives

Woman Engineer of the Year Award

Prof. Sanghamitra Bandyopadhyay - Designing Lead Molecules: An Algorithmic Approach

Dr. VR Lalithambika - Guidance and control design and validation challenges for winged entry vehicles

Dr. Dheepa Srinivasan - Marvels of Advanced Gas Turbine Materials Technologies

January 6, 2021 (Wednesday)

Session on Lectures by Newly Elected Fellows under Rule 37(g) and Lectures by INAE Young Entrepreneur Award Winners:

Session Chairperson: *Dr. Sanak Mishra, President, INAE (2019-2020)*

Lectures by Newly elected Fellows under Rule 37(g)

- Dr. Ravindra D Kulkarni - Innovation driven specialty silicone business for global market
- Mr. SK Roongta - Experiences with people relating to creativity & positivity

INAE Young Entrepreneur Awardees

- Dr. Anuya A. Nisal - Silk cocoons to bone void fillers: unravelling the story

January 7, 2021 (Thursday)

Session on Lectures by Newly elected Fellows/Foreign Fellows and Young Engineer Awardees affiliated to Engg Section-I (Civil Engineering):

Session Chairperson: Prof. SK Bhattacharyya

Lecture by Fellows/Foreign Fellows

- Prof. CSP Ojha - A Holistic Approach to Management of Indian Water Resources
- Dr. N Subramanian - Cold-Formed Steel Sections-Review of Our Research
- Prof. MM Ghangrekar - Exploiting biological and bio-electrochemical wastewater treatment technologies to facilitate reuse of treated water and resource recovery
- Prof Nemkumar Banthia - Civil Infrastructure with Sensors and Cyber-Physical Networks

Lectures by Young Engineer Awardees

- Dr. N. M. Anoop Krishnan - Accelerating materials discovery with data-driven and physics-driven modeling
- Dr. Swatantra Pratap Singh - Laser-Induced Graphene Filters and Membranes for Desalination and Water Purification

January 8, 2021 (Friday)

Session on Lectures by Newly elected Fellows/Foreign Fellows and Young Engineer Awardees affiliated to Engg Section-II (Computer Engineering and Information Technology):

Session Chairperson: Prof. Subhasis Chaudhuri

Lecture by Fellows/Foreign Fellows

- Dr. Suparna Bhattacharya - The silent learner and the oblivious teacher: Meaning aware storage for AI
- Dr. Harrick Vin - Cognitive Automation and ignio™
- Prof. Naveen Garg - Scheduling to minimize energy
- Prof. Sudip Misra - IoT Network Adoption in Constrained Environments

Lectures by Young Engineer Awardees

- Dr. Pawan Goyal - A Graph Based Framework for Structured Prediction Tasks in Sanskrit
- Dr. Neeldhara Misra - Algorithmic Aspects of the Firefighting Problem



January 9, 2021 (Saturday)

Session on Award Lectures by Award Winners of INAE Young Entrepreneur Award and Innovative Student Projects Award at Doctoral Level:

Session Chairperson: Prof. Indranil Manna, President, INAE (2021-)

Award Winner of INAE Young Entrepreneur Award

- Mr. Akshay V. Singhal - Need for customised and indigenous Battery Solutions for mass scale EV Adoption in India

Award Winners of Innovative Student Projects Award at Doctoral Level

- Dr. Stefie J. Stephen - Incorporation of time-dependent fracture behaviour in the structural design of fibre reinforced concrete elements
- Dr. Asha Das - Automated Nuclear Pleomorphism Scoring in Histopathological Breast Cancer Images
- Dr. Kuppuraj Rajamanickam - On the quantification of two-phase flow interactions using time-resolved laser diagnostic tools
- Dr. Akshay Modi - Functionally coated polyethersulfone nanocomposite hollow fiber membranes showing excellent biocompatibility and uremic toxins clearance for bioartificial kidney application
- Dr. Priyank Mukeshkumar Shah - Leakage Current Suppression in Double Stage SECS Enabling Harmonics Suppression Capabilities
- Dr. Sayan Dey - NiO based sensors for VOC and heavy metal ion detection
- Dr. Chandan Bose - Dynamical Analysis of the Unsteady Flow Phenomena around a Flapping Wing
- Dr. Jhansi Jadav - Assessment of precipitation, deformation and fracture behavior of Superalloy 263 Ni base superalloy under tensile and low cycle fatigue conditions
- Dr. Debanjan Das - New Avenues to Transition-Metal Based Water Splitting Electrocatalysts
- Dr. Souvik Ghosh - Next-Generation Optical Nanotweezers for Dynamic Manipulation

January 11, 2021 (Monday)

Session on Lectures by Newly elected Fellows/Foreign Fellows/ Young Engineer Awardees affiliated to Engg Section-III (Mechanical Engineering):

Session Chairperson: Prof. Pradip Dutta

Lecture by Fellows/Foreign Fellows

- Prof. Soumitra Paul - Control of fibre-damage in C fibre reinforced SiC ceramic matrix composite by high-speed diamond grinding
- Dr. Pramod Kumar - Realizing the Supercritical CO₂ Brayton cycle – Challenges and Opportunities
- Prof. Amitava Datta - Rich and Partially Premixed Flames and their Application in LPG Burners
- Dr. R Balasubramaniam - Micro Nano Engineering for Strategic Applications and Rural Upliftment

Lectures by Young Engineer Awardees

- Dr. Prosenjit Das - Rheo-pressure die casting process technology of Al-Si alloys: Towards development of Automobile components

January 12, 2021 (Tuesday)

Session on Lectures by Newly elected Fellows/Foreign Fellows/Young Engineer Awardees affiliated to Engg Section-IV (Chemical Engineering):

Session Chairperson: Prof. AB Pandit

Lecture by Fellows/Foreign Fellows

- Dr. JS Raut - Microbiomics – Role of Microbe-Microbe interaction in Shaping Microbial Communities
- Prof. KK Pant - Exploring the binary and ternary nanocatalysts for conversion of coal and biomass derived CO₂ rich syngas to methanol and DME: Fundamental challenges and opportunities
- Prof. S. Pushpavanam - Paper Based Microfluidics for point of care diagnostics
- Mr Bipin V Vora - Development of Catalytic Processes for Production of Olefins
- Prof Nicholas A Peppas - Engineering Intelligent Materials Structures for Biomedical Applications

Lectures by Young Engineer Awardees

- Dr. Ravi Kumar Arun - Paper based microfluidics for energy conversion and lab on chip applications
- Dr. Rahul Mangal - Active Matter in Complex Surroundings

January 13, 2021 (Wednesday)

Session on Lectures by Newly elected Fellows/Foreign Fellows/Young Engineer Awardees affiliated to Engg Section-V (Electrical Engineering):

Session Chairperson: Prof. Ashok Kumar Pradhan

Lecture by Fellows/Foreign Fellows

- Prof. Anil Kulkarni - Coordinated Damping Control of Inter-Area Power System Oscillations using Wide-Area Measurements and Grid-Connected Converter Systems
- Prof. L. Umanand - Challenges in going electric
- Prof. IN Kar - Robust Control of a class of Robotic Systems
- Dr. AP Tiwari - Design of Control and Estimation Algorithms for Nuclear Reactors

Lectures by Young Engineer Awardees

- Dr. Swaroop Subhash Gajare - Real Time Verification and Modelling of Series Compensated Transmission Lines
- Dr. Sumit Kumar Pramanick - Technologies Related to High Frequency Switched Converters



January 14, 2021 (Thursday)

Session on Lectures by Newly elected Fellows/Foreign Fellows and Young Engineer Awardees affiliated to Engg Section-VI (Electronics & Communication Engineering):

Session Chairperson: Prof. V Ramgopal Rao

Lecture by Fellows/Foreign Fellows

- Prof. Jayadeva - Learning Small Models: The Minimum Complexity Machine and its extensions
- Dr. Chandrakanta Kumar - Innovations in Antenna Designs for the National Space Missions
- Prof. MV Kartikeyan - Millimeter Wave/Sub-THz Sources for Clean Energy and Other ISM Applications
- Prof. Maryam Shojaei - Sensing from signal conditioning to the network
- Dr. CP Ravikumar - Modern Challenges in VLSI Design and Test

Lectures by Young Engineer Awardees

- Dr. Digbijoy N Nath - Wide Band Gap Semiconductor Devices for Power/RF Electronics and Deep-UV Opto-Electronics
- Dr. Raghvendra Kumar Chaudhary - Compact Metamaterial Antennas and MIMO Cognitive Radio System for 5G Application

January 15, 2021 (Friday)

Session on Lectures by Newly elected Fellows/Foreign Fellows and Young Engineer Awardees affiliated to Engg Section-VII (Aerospace Engineering):

Session Chairperson: Mr. T Suvarna Raju

Lecture by Fellows/Foreign Fellows

- Dr. VR Lalithambika - Challenges in atmospheric phase autopilot design and simulation for expendable Launch Vehicles
- Mr. MS Suresh - Development of turbopump systems for Cryogenic and Semicryogenic Propulsion systems of ISRO
- Dr. Samikkanu Raja - Novel Aeroelastic Solutions for Indian Aerospace Programmes
- Dr. Dinesh Srivastava (affiliated to ES-VIII) - Nuclear Fuel Complex – Engineering Challenges

January 18, 2021 (Monday)

Session on Lectures by Newly elected Fellows/Foreign Fellows and Young Engineer Awardees affiliated to Engg Section-VIII (Mining, Metallurgical and Materials Engineering):

Session Chairperson: Prof. Amol A Gokhale

Lecture by Fellows/Foreign Fellows

- Dr. Harish C Barshilia - Next generation nano coatings for aerospace and engineering applications
- Dr G Padmanabham - Laser – A Wonderful Tool for Materials Processing
- Prof. UV Waghmare - Predictive Models and Simulations of Materials using Quantum Mechanics and Machine Learning

Lectures by Young Engineer Awardees

- Dr. Pooja Devi - Engineered Materials for Water Pollutants Monitoring and Hydrogen Energy for Sustainable Goals
- Dr. Mudrika Khandelwal - Fermentation derived cellulose (Bacterial Cellulose) for healthcare and environment

January 19, 2021 (Tuesday)

Session on Lectures by Newly elected Fellows/Foreign Fellows and Young Engineer Awardees affiliated to Engg Section-IX (Energy Engineering):

Session Chairperson: Mr. Pradeep Chaturvedi

Lecture by Fellows/Foreign Fellows

- Dr. Anuradda Ganesh - Biomass and Bioenergy—where is the tipping point?
- Dr. Suddhasatwa Basu - Energy on Fingertips: Membrane-less Microfluidic Water Electrolyser for Hydrogen and Oxygen Production
- Dr. AK Nayak - Technology development for passive safe advanced nuclear reactors for a low-carbon climate resilient future India
- Dr. SSV Ramakumar (affiliated to ES-X) - Lubricants, Nanotech and CCUS- A Kaleidoscopic glimpse of some of my career research Pursuits

January 20, 2021 (Wednesday)

Session on Lectures by Newly elected Fellows/Foreign Fellows and Young Engineer Awardees affiliated to Engg. Section-X (Interdisciplinary and Special Engineering Fields and Leadership in Academia, R&D and Industry):

Session Chairperson: Prof. Rudra Pratap

Lecture by Fellows/Foreign Fellows

- Prof. Soumyo Mukherji - Nanostructure Enabled Optical Fiber Bio(chemical) sensors
- Dr. Sharmila S. Mande - Little bugs with Big Data: Mining 'Microbiomes' for improving health
- Prof. Ambarish Ghosh - Multifunctional helical nanoswimmers

Lectures by Young Engineer Awardees

- Dr. D. Josephine Selvarani Ruth - Shape Memory Alloy based human-machine interaction devices.



The presentations were uploaded on the INAE Website for the benefit of researchers and readers. The Annual Convention Webinar Series presented an exciting opportunity for the awardees and newly elected Fellows to interact with the Fellows and invitees on pertinent technical issues. The webinar series was unique in its outlay and was an outstanding success and appreciated by all delegates. Due to privacy issues the webinars are accessible to INAE Fellows through their login.

Summing up meeting of Annual Convention Organizing Committee (ACOC) 2020 held on January 29, 2021

A summing up meeting of Annual Convention Organizing Committee (ACOC) was held on January 29, 2021 to discuss way forward for such flagship INAE events and obtain Committee's recommendation on mode of presentation of such events in future. The Committee recommended that in the near future INAE flagship Events like NatFOE, Engineers Conclave, Youth Conclave and Annual Convention may be held on hybrid mode i.e., the option of participating or attending the events online will be provided to Fellows and other invitees even if the events are held physically. This will provide opportunity for more people to attend the INAE events. The Committee also advised that events of shorter duration may be planned in the future so as to improve the participation since it has been observed that attendance declines in events of longer duration.

Digital Content and Webinars Committee

A special Committee to oversee content, speakers and other relevant issues in planning of webinars under the INAE Webinar Series initiative and also review relevant Digital content generated through different activities of INAE was formed during September 2020. The first meeting of Digital Content and Webinars Committee was held on February 11, 2021 for proposing policy on web publication of webinars and other event generated content. The Committee deliberated on the award lectures and technical session presentations which were organized as a webinar series during January 4 - 20, 2021. It was recommended that the valuable web content, generated as part of INAE Annual Convention will be placed under login facility of Fellows and Young Associates to restrict access. Accordingly, the content has been placed in INAE Server under authenticated login for Fellows and Young Engineers.

Publications of the Academy

Special Issue of Transactions of the Indian National Academy of Engineering - Volume 5, Issue 2, June 2020 on “Technologies for Fighting COVID-19”

INAE had launched a quarterly journal “INAE Letters” published by M/s Springer in the year 2016. The objective of the journal was to provide a medium for rapid publication of new research results and invited short review articles across different domains of engineering science and technology. In the year 2020, the title of the Journal was changed to “**Transactions of Indian National Academy of Engineering – An International Journal of Engineering and Technology**” and has become a full-fledged journal to include full Research Papers and Review Articles besides short communications. Prof. K. Bhanu Sankara Rao has been chosen as the Editor-in-Chief of this journal.

A special issue of Transactions of the Indian National Academy of Engineering - Volume 5, Issue 2, June 2020 on “Technologies for Fighting COVID-19” was brought out. The idea of bringing out a special issue was conceived keeping in view that there are several technologies available in the country that can be suitably modified to mitigate various aspects in the fight against the COVID-19 Pandemic. The journal provides a platform for collating appropriate technologies and for bringing the inventors and industries together to ensure successful translation of the technologies into practice for the benefit of the citizens. In response to the call for articles for the special issue of Transactions of the Indian National Academy of Engineering, a large number of high-quality submissions were received, out of which 49 papers were published after a rigorous review process. The papers were received from INAE Fellows and other eminent engineers and technologists from across the spectrum of Academia, R&D and Industry. The special issue also serves as a collation of information on high technology readiness for various gadgets necessary for identification and effectively tackling COVID -19, many of which are ready for commercial exploitation. The soft copy of the special issue of journal was made available on the Springer website in open domain for the benefit of readers and researchers from across the globe. Transactions of INAE is the only international journal in the world that brought a timely issue on “Technologies for Fighting COVID-19”.

Fourth Report of INAE Forum on “Technology Foresight and Management for addressing National Challenges”

The fourth report of the INAE Forum on “Technology Foresight and Management for addressing National Challenges”, chaired by Mr VK Agarwal was brought out in November 2020 which covers three broad areas viz. (a) Issues of Environment / Climate Change / Sustainability (b) Rail-based Infrastructure Urgently Needs Four Major Interventions at the Level of Government of India (c) Improving the Operating Ratio of Indian Railways – A Way Forward. the fourth Report has the mandate to evolve solutions keeping in view the issues of Environment, Climate Change, Sustainability, Rail-based Infrastructure, and Improving the Operating Ratio of Indian Railways in focus and suggest appropriate technologies accordingly. It is envisaged that the report shall be of immense benefit to all stakeholders from Government, industry and R&D organizations in addressing these challenges and suggesting an action plan for growth of these sectors and shall be well accepted by the engineering community in domains of interest.

Training Programmes attended by INAE Staff

Training of the trained employees is crucial for achieving excellence in organizational operations. Keeping this in view, INAE staff are encouraged to attend regular training programs for knowledge upgradation and keeping pace with changing technologies. In the financial year 2020-21, INAE staff participated in the following training programs.

One day Online Training programme on “Preventive Vigilance” through Virtual platform was conducted by Department of Science & Technology on October 29, 2020 for nominated officers of Autonomous Institutions part of observance of Vigilance Awareness Week from 27th October to 2nd November 2020. Lt Col Shobhit Rai (Retd), Deputy Executive Director, INAE, Ms. Shelika Arora, Research Officer, Mr. Rahul Garg, Assistant Systems Engineer and Ms. Hema Gupta, Senior Assistant, Grade-I were nominated to attend the programme. Mr Sowmendra Chanda, Deputy Secretary (Vigilance), Department of Science & Technology, New Delhi welcomed all the participants. Mr. Chanda started the session with the objective of this training and shared brief profile of trainer, Mr Deepak Kumar Bisht, Joint Director (PT), Institute of Secretariat Training & Management (ISTM).

It was mentioned by Mr Sowmendra Chanda that various trainings were conducted in past for Vigilance officers. However, this was the first time that this training was conducted for nominated officers of AIs, other than Vigilance officers. The programme emphasized on Vigilance and types of Administration Vigilance. The sources of information in the organisation for vigilance were explained. The two types of Participative Vigilance i.e. Preventive Vigilance and Punitive Vigilance were discussed in detail to improve systems and procedure to eliminate corruption and good governance. The different cases for implementation of CCS (CCA) rules were discussed to find out the lacunae in rules, procedure that let or gave scope for misconduct and to take corrective action. The various other cases of Vigilance angle were also discussed. The conduct rules for officials like integrity, employment of near family members, subscription, gift, private trade or employment, Investment lending & borrowing, and properties were also explained during the session. At the end of session various situations for comments of the participants were discussed. The training ended by resolving the queries from Participants. Mr Sowmendra Chanda ended the session with vote of thanks.

A two-webinar series on “The Finer Points of abstracting and Indexing-Scopus and Web of Science” was conducted by Springer Nature. One day webinar on “Web of Science – Overview and latest developments” was held on February 22, 2021 and One day webinar on “Scopus – Overview, evaluation process and staying indexed” was conducted by Springer on February 17, 2021. Ms. Shelika Arora, Research Officer, INAE was nominated to attend the two-webinar series. The programme addressed the concerns of maximum visibility and discoverability through appropriate abstracting and indexing services.

A Two Days’ e-Training Programme on Public Procurement of Goods: Insight GeM & e-Procurement conducted by National Productivity Council, Jaipur (Under M/o Commerce and Industries, DPIIT, GOI). The e-training programme was held on March 17-18, 2021. Mr. Gaurav Kandalgaonkar (Assistant Grade II) was nominated to attend the programme. The objective of programmes was to educate the participants about Procurement & Contracting procedures and to understand the fundamental principles & techniques in detail. The prime moto of the programme was to provides an understanding of procurement methods of PSU’s / Government.

The programme contents vividly covered all important aspects of procurement viz. procurement process, process of tendering, bidding and reverse auction, procurement through GeM and outside GeM and relevant portion of GFR

2017. The programme helped in understanding of the principles of effective procurement, and related activities. The programme covered various aspects of procurement planning and development of specifications for procurement. It clarified the doubts on Invitation & evaluation of Bids & Proposals. The programme highlighted practice of ethics & integrity in procurement.

The INAE Staff is encouraged to participate in Training Programmes in the future as well.

Contribution by INAE Staff

INAE Staff has contributed one day's salary amounting to Rs 33,715/- to PM CARES FUND for the cause of COVID-19.



Statement of Accounts

2020-21



Indian National Academy of Engineering



JAIN PRAMOD JAIN & CO.
CHARTERED ACCOUNTANTS

Phone : 41401901
Email : jainpjco@gmail.com
F-591, Sarita Vihar,
New Delhi - 110076

THE MEMBERS
INDIAN NATIONAL ACADEMY OF ENGINEERING
NEW DELHI-110016

AUDITORS' REPORT

We report that we have audited the Balance Sheet of **INDIAN NATIONAL ACADEMY OF ENGINEERING** as at March 31st, 2021 and also the Income and Expenditure Account for the year ended on that day annexed thereto. These Financial statements are the responsibility of the Academy's Management. Our responsibility is to express an opinion on these financial statements based on our Audit.

We conducted our Audit in accordance with auditing standards generally accepted in India. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An Audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An Audit also includes assessing the accounting principles used and significant estimates made by the management, as well as evaluating the overall financial statement presentation. We believe that our Audit provides a reasonable basis for our opinion.

We report that;

- (i.) We have obtained all that information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit.
- (ii.) In our opinion, proper books of account as required by the law have been kept by the Academy so far as appears from our examination of those books.
- (iii.) The Balance Sheet and the Income and Expenditure Account dealt with by this report are in agreement with the books of account.
- (iv.) In our opinion, the Balance Sheet and Income and expenditure Account dealt with by this report comply with the accounting standards.
- (v.) In our opinion and to the best of our information and according to the explanations given to us the said accounts, read with accounting policies and Notes to Accounts thereon, give a true and fair view in conformity with accounting principles generally accepted in India:
 - a) In the case of Balance sheet , of the state of affairs of the Academy as at March 31,2021 and
 - b) In the case of Income and Expenditure Account, of the surplus of Income over Expenditure of the Academy for the year ended on March 31st, 2021.

Place: New Delhi
Date: 25.06.2021



For Jain Pramod Jain & Co.
Chartered Accountants
(Firm Registration No. 016746 N)

P.K. Jain

(P.K.Jain)
Partner

Membership No. 010479
UDIN: 21010479AAAAABD2180

INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

BALANCE SHEET AS AT 31ST MARCH, 2021

(Amount -Rs.)

	Schedule	Current Year 2020-21	Previous Year 2019-20
<u>CORPUS/CAPITAL FUND AND LIABILITIES</u>			
CORPUS/ GENERAL FUND	1	1135,57,837	1099,14,706
RESERVE AND SURPLUS	2	-	-
EARMARKED/ ENDOWMENT FUNDS	3	25,43,651	24,76,778
SECURED LOANS AND BORROWINGS	4	-	-
UNSECURED LOANS AND BORROWINGS	5	-	-
DEFERRED CREDIT LIABILITIES	6	-	-
CURRENT LIABILITIES AND PROVISIONS	7	553,30,109	405,53,372
Total		1714,31,597	1529,44,856
<u>ASSETS</u>			
FIXED ASSETS	8	227,99,460	251,59,703
INVESTMENTS - FROM EARMARKED/ENDOWMENT FUNDS	9	-	-
INVESTMENTS - OTHERS	10	957,00,000	845,00,000
CURRENT ASSETS, LOANS, ADVANCES ETC.	11	529,32,137	432,85,153
MISCELLANEOUS EXPENDITURE(to the extent not written off or adjusted)		-	-
Total		1714,31,597	1529,44,856
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LAIBILITIES AND NOTICES ON ACCOUNTS	25		

As per our report of even date

For JAIN PRAMOD JAIN & CO.
CHARTERED ACCOUNTANTS
(Firm Reg. No. - 016746N)

P.K. Jain
P.K. Jain
Partner
(Membership No. 010479)
Place: *New Del.*
Dated: **25 JUN 2021**



Manager
Manager (F & A)

On behalf of the Council:

President : *Indranil*

Vice-President : *Pramod Jain*
(Finance & Establishment)

Deputy Executive Director : *Pranav*



INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2021

(Amount -Rs.)

INCOME	Schedule	Current Year 2020-21	Previous Year 2019-20
Income from Sales/Services	12	-	-
Grants / Subsidies	13	760,07,719	821,24,580
Fees/ Subscriptions	14	-	65,000
Income from Investments	15	26,76,610	30,78,625
Income from Royalty, Publication etc.	16	82,878	7,416
Interest Earned	17	42,86,467	40,76,500
Other Income	18	1,45,881	2,221
Withdrawal from Corpus Fund (reference Schedule-1)		-	116,03,895
Increase/(decrease) in stock of Finished goods and work-in-progress	19	-	-
Total (A)		831,99,555	1009,58,237
Expenditure			
Establishment Expenses	20	151,59,396	259,59,924
Other Administrative Expenses etc.	21	37,36,773	48,22,369
Expenditure on Engineering Programmes and Activities	21-A		
i) Seminars / Conferences / Symposiums / Workshops		72,710	52,13,268
ii) INAE Chair , Distinguished Professors & Mentoring Schemes		11,19,925	27,11,719
iii) Research Studies/ Projects		21,59,690	17,53,852
iv) INAE Awards		46,10,000	49,08,299
v) Academia-Industry Interaction AICTE-INAE Schemes		41,49,211	85,71,700
vi) INAE Forums		11,987	3,91,658
vii) Academy Meetings		80,621	35,13,365
viii) Annual Convention		15,76,331	36,72,322
ix) International Affairs		-	15,36,304
x) INAE Publications		3,49,598	15,51,779
xi) Financial Assistance for Engineering Activities		-	5,00,000
xii) SERB-INAE Abdul Kalam Technology Innovation National Fellowship		418,73,909	274,01,615
xiii) INAE Digital Platform		9,62,355	84,134
Expenditure on Grants, Subsidies etc.	22	-	-
Interest	23	6,47,782	2,26,913
Depreciation (Net Total at the year end - corresponding to Schedule 8)		25,75,298	28,83,771
Total (B)		790,85,586	957,02,992
Balance being excess of Income over expenditure (A-B)		41,13,969	52,55,245
Transfer to DKRC Development Fund		66,873	72,139
Transfer to Corpus Fund		26,09,737	30,06,486
Transfer to Fixed Assets (Grant utilised for Capital Assets)		3,73,972	12,10,804
BALANCE BEING SURPLUS / (DEFICIT) CARRIED TO GENERAL FUND		10,63,387	9,65,816
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

As per our report of even date

On behalf of the Council:

For JAIN PRAMOD JAIN & CO.
 CHARTERED ACCOUNTANTS
 (Firm Reg. No. - 016746N)

P. K. Jain
 P.K. Jain
 Partner
 (Membership No. 010479)
 Place: *New Delhi*
 Dated: *25 JUN 2021*



[Signature]
 Manager (F & A)

[Signature]
 President

[Signature]
 Vice-President
 (Finance & Establishment)

[Signature]
 Deputy Executive Director

INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

SCHEDULE 1 - CORPUS/GENERAL FUND	General Fund	INAE Corpus Fund	General Fund	INAE Corpus Fund	Total	Total
	2020-21	2020-21	2019-20	2019-20	2020-21	2019-20
Balance as at beginning of the year	647,66,874	451,47,832	638,01,058	537,45,241	1099,14,706	1175,46,299
Less :						
Unspent balance of PURA Project . to TIFAC	29,993		-	-	29,993	-
Withdrawn towards payment of Interim relief to Staff	-	-	-	116,03,895	-	116,03,895
Add :						
Corpus received						
Transferred (to)/from Income and Expenditure A/c	10,63,387	26,09,737	9,65,816	30,06,486	36,73,124	39,72,302
BALANCE AT THE YEAR END	658,00,268	477,57,569	647,66,874	451,47,832	1135,57,837	1099,14,706


 (Bhuwan Adhikaria)
 Manager (F&A)





INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

SCHEDULE 2 - RESERVES AND SURPLUS :		Current Year 2020-21		Previous Year 2019-20	
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 Adhlakha)
Manager (F&A)

INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

SCHEDULE 3- EARMARKED/ENDOWMENT FUNDS		Current Year 2020-21	Previous Year 2019-20
DKRC Development Fund			
a. Opening balance		24,76,778	24,04,639
b. Additions to the funds			
i Transferred (to)/from Income and Expenditure A/c		66,873	72,139
c. Utilisation for the purpose		-	-
BALANCE AT THE YEAR END Total : (a+b)		25,43,651	24,76,778



(Bhuwan Adhlakha)
Manager (F&A)

INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

SCHEDULE 4 - SECURED LOANS AND BORROWING:	Current Year 2020-21		Previous Year 2019-20	
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				

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



INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

SCHEDULE 5 - UNSECURED LOANS AND BORROWING:	Current Year 2020-21	Previous Year 2019-20
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 2020-21	Previous Year 2019-20
a) Acceptance secured by hypothecation of capital equipment and other assets	-	-
b) Others	-	-
Total	Nil	Nil
Note : Amounts due within one year		

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





INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

SCHEDULE 7 - CURRENT LIABILITIES AND PROVISIONS				Current Year 2020-21		Previous year 2019-20	
A. CURRENT LIABILITIES							
1	Salary Payable			-		-	
2	TDS Payable			50,978		41,273	
3	Expenses/Bills Payable			2,96,355	3,47,333	4,84,042	5,25,315
4	Audit Fee Payable				70,800		64,900
5	Unspent DST Grant			209,04,275		125,69,736	
6	Unspent AICTE Grant for DVP Scheme			57,85,957		(1,363)	
7	Unspent AICTE Grant for Teachers Research Fellowship Scheme			-		34,65,358	
8	Unspent AICTE Grant for Travel Grant Scheme			27,53,250		11,68,577	
9	Unspent Earmarked SERB Grant for Abdul Kalam T. Innovation National Fellowship			125,94,258	420,37,740	97,10,507	269,12,815
B. PROVISIONS							
1	Provision for Gratuity				68,04,319		69,78,556
2	Provision for Leave Encashment				60,69,917		60,71,786
TOTAL					553,30,109		405,53,372



(Bhuwan Adhlakha)
Manager (F&A)

SCHEDULE 8 - FIXED ASSETS

Description	Original cost of Asset as on 01.04.20	Asset Purchased during the year	Value of assets Disposed off/ sold	Original cost of Asset as on 31.03.21	Total Dep. Upto 01.04.20	Dep. for the Year 2020-21	Depreciation on Assets Disposed off / sold	Utilisation of Grant u/s 11(1)	Total up to 31.03.21	Net Block of Asset as at 31.03.21	Net Block of Asset as at 31.03.20
	1	2	3	4	5	6	7	8	9	10	11
A. FIXED ASSETS											
Part-I Equipments	5831686	0	0	5831686	4744836	167931	0	0	4912767	918919	1086850
Part - II Furniture	13961692	0	0	13961692	9787318	417440	0	0	10204758	3756934	4174374
Part - III Building	53741479	0	0	53741479	33846490	1989499	0	0	35835989	17905490	19894989
Part-V Software -Digital Platform	5003998	373972	0	5377970	5003998	0	0	373972	5377970	0	0
	78538855	373972	0	78912827	53382642	2574870	0	373972	56331484	22581343	25156213
Part-IV Equipments out of Project Grant	44744	0	0	44744	41254	428	0	0	41682	3062	3490
Total :	78583599	373972	0	78957571	53423896	2575298	0	373972	56373166	22584405	25159703
B. CAPITAL WORK-IN-PROGRESS											
Software -Digital Platform	-	2,15,055	-	2,15,055	-	-	-	-	-	2,15,055	-
TOTAL	78583599	589027	0	79172626	53423896	2575298	0	373972	56373166	22799460	25159703

(Bhuwan Adhlakha)
Manager (F&A)



INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

SCHEDULE 9 - INVESTMENT FROM EARMARKED/ENDOWMENT FUNDS		Current Year 2020-21	Previous Year 2019-20
1 Others (Term Deposit with SBI)		-	-
TOTAL			-

SCHEDULE 10 - INVESTMENTS - OTHERS		Current Year 2020-21	Previous Year 2019-20
1 Corpus Fund (Term Deposit with SBI)		462,00,000	405,00,000
2 Others (Term Deposit with SBI)		495,00,000	440,00,000
TOTAL		957,00,000	845,00,000


 (Bhuwan Adhlakha)
 Manager (F&A)





INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2021

SCHEDULE 11 - CURRENT ASSETS, LOANS, ADVANCES ETC.	Current Year 2020-21		Previous Year 2019-20	
A. CURRENT ASSETS:				
1 Cash balances in hand (Including Cheque/ Draft, Revenue Stamps and Imprest)		16,506		18,793
2 Bank Balance:				
a) With Scheduled Banks:				
- On Current Accounts				
- On Saving Account	451,66,766	451,66,766	311,80,823	311,80,823
Total (A)		451,83,272		311,99,616
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	2,25,994		74,862	
b) Advance to Expert Groups	14,95,676			
c) Others	19,46,833	36,68,503	16,42,273	17,17,135
2 Income Accrued				
a) On Investment from Earmarked/Endowment Funds	-		-	
b) On investments - others	29,93,919	29,93,919	88,70,852	88,70,852
3 Claims Receivable				
a) TDS Receivable	10,47,943		14,59,050	
b) Security Deposit	38,500	10,86,443	38,500	14,97,550
Total (B)		77,48,865		120,85,537
Total (A+B)		529,32,137		432,85,153

(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, 2021

SCHEDULE 12 - INCOME FROM SALES/SERVICES	Current Year 2020-21	Previous Year 2019-20
1) Income from Sales		
a) Sale of Finished Goods	-	-
b) Sale of Raw Material	-	-
c) Sale of Scrap	-	-
2) Income from Services		
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, 2021

<u>SCHEDULE 13 - GRANTS/SUBSIDIES</u> (Irrevocable Grants & Subsidies Received)	Current Year 2020-21	Previous Year 2019-20
1 Central Government	298,72,493	457,89,065
2 Government Agencies	460,23,120	359,73,315
3 International Organisations	72,106	70,200
4 Other		
- Contribution for INAE Annual Convention	-	2,07,000
- Contribution for Workshop on MSW Processing Technologies- organised by Mumbai Chapter	-	85,000
- Contribution for BUMA-IX delegation	-	-
- Contribution received by Bangalore Chapter from ADA	40,000	-
- Contribution for Seminar on Civil Aviation from ISRO	-	-
- Contribution from NIAS	-	-
Total	760,07,719	821,24,580

<u>SCHEDULE 14 - FEES/SUBSCRIPTIONS</u>	Current Year 2020-21	Previous Year 2019-20
1 Seminar/Program Fees		
Registration fee for Workshop on MSW Processing Technologies- by INAE Mumbai Chapter	-	65,000
Total	-	65,000

Note - Accounting policies towards each item are to be disclosed



(Signature)
(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, 2021

SCHEDULE 15 - INCOME FROM INVESTMENTS (Income on Invest. from Earmarked/Endowment Funds transferred to funds)	Investment from Earmarked Fund		Investment - Others	
	Current Year 2020-21	Previous Year 2019-20	Current Year 2020-21	Previous Year 2019-20
1 Others (Interest from Term Deposit)	66,873	72,139	26,09,737	30,06,486
TOTAL	66,873	72,139	26,09,737	30,06,486
TRANSFERRED TO EARMARKED/ENDOWMENT FUNDS	66,873	72,139	26,09,737	30,06,486

SCHEDULE 16 - INCOME FROM ROYALTY, PUBLICATION ETC.	Current Year 2020-21	Previous Year 2019-20
1) Income from Royalty	82,878	7,416
TOTAL	82,878	7,416

SCHEDULE 17 - INTEREST EARNED.	Current Year 2020-21	Previous Year 2019-20
1) On Term Deposits:		
a) With Scheduled Banks	26,74,884	32,23,339
2) On Savings Accounts:		
a) With Scheduled Banks	16,11,583	8,53,161
TOTAL	42,86,467	40,76,500
Note - Tax deducted at source to be indicated	2,00,616	3,22,334

SCHEDULE 18 - OTHER INCOME.	Current Year 2020-21	Previous Year 2019-20
1) Profit on Sale/disposal of Assets: (Net)		
a) Owned Assets	-	-
2) Miscellaneous Income	1,45,881	2,221
TOTAL	1,45,881	2,221




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INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDED 31ST MARCH, 2021

SCHEDULE 19 - INCREASE/(DECREASE) IN STOCK OF FINISHED GOODS & WORK IN PROGRESS.	Current Year 2020-21	Previous Year 2019-20
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, 2021

SCHEDULE 20 - ESTABLISHMENT EXPENSES.	Current Year 2020-21	Previous Year 2019-20
1 Salaries and Wages	142,67,952	127,04,693
2 Interim Relief paid - pending release of grant of 7th CPC	7,90,695	132,97,786
3 Contribution to NPS/PPF	13,13,067	10,49,403
4 Contribution to Gratuity and Leave Encashment	(41,269)	5,24,043
5 Staff Welfare Expenses	80,500	-
6 Leave Travel Concession (LTC)	2,31,746	77,890
Sub-total	166,42,691	276,53,815
Less: Interim relief debited to AICTE Schemes	4,83,295	6,93,891
Less: Interim relief & salary debited to SERB -Abdul Kalam TI National Fellowship	10,00,000	10,00,000
TOTAL	151,59,396	259,59,924

SCHEDULE 21 - OTHER ADMINISTRATIVE EXPENSES ETC.	Current Year 2020-21	Current Year 2019-20
1 Electricity and power	2,80,312	3,17,043
2 Water Charges	1,284	1,887
3 Insurance	31,268	26,460
4 Repairs and maintenance	24,63,968	26,10,437
5 Rent, Rates and Taxes	1,43,095	1,44,047
6 Postage, Telephone and communication Charges	2,50,862	4,12,930
7 Printing and Stationary	1,71,129	4,46,761
8 Travelling and Conveyance Expenses	37,913	73,583
9 Subscription Expenses	1,53,282	1,18,000
10 Auditors Remuneration	70,800	64,900
11 Professional Charges	81,140	1,09,420
12 General Expenses	1,07,659	1,14,938
13 Bank Charges	8,031	30,614
14 Books and Periodicals	490	140
15 Website Expenses	27,140	2,37,704
16 Advertisement and Publicity	8,400	2,13,505
Sub-total	38,36,773	49,22,369
Less: Expenditure Debited to SERB Abdul Kalam TIN Fellowship Scheme	1,00,000	1,00,000
Less: Expenditure Debited to AICTE Schemes	-	-
TOTAL	37,36,773	48,22,369




 (Bhuwan Adhlakha)
 Manager (F&A)

INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI
SCHEDULES FORMING PART OF INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021

(Amount in Rs)

SCHEDULE 21-A -ENGINEERING PROGRAMMES AND ACTIVITIES	Current Year 2020-21		Previous Year 2019-20	
	Details	Total	Details	Total
Expenditure On				
INAE Seminars/Conferences/Symposium/Workshops				
Conferences :-				34,03,124
INAE Youth Conclave	-	-	12,03,738	
Engineers Conclave	-	-	21,99,386	
Symposium:-				10,52,159
National Frontiers of Engineering	-	-	10,52,159	
Seminars :-		72,710		-
INAE Webinar Series	72,710			
Workshops:-				7,57,985
Round Table on Role of Hydrogen in India's Energy Strategy by Pune Chapter	-	-	1,31,310	
Participation in Indian Science Congress	-	-	39,257	
Workshop on Imagining Future of INAE	-	-	83,618	
Workshop on FLSM1 by Kolkata Chapter	-	-	2,28,503	
Workshop on MSW Processing Technologies by Mumbai Chapter	-	-	1,18,288	
Workshop on Recent Advances in Science & Technology- Kolkata Chapter	-	-	78,763	
Workshop on Urban Transportation by INAE Forum on Civil Infrastructure	-	-	78,246	
INAE Schemes		11,19,925		27,11,719
Distinguished Technologists / Professors	6,00,000		-	
INAE Chair Professorships	3,98,950		1,02,375	
Mentoring of Engineering Teachers	60,000		5,28,383	
Mentoring of Engineering Students	60,975		9,43,838	
Frugal Innovation Nurturing Programme- FINP	-		4,27,574	
Travel Grant Scheme	-		7,09,549	
Research Studies / Projects		21,59,690		17,53,852
Expert Group By Prof. DN Singh on Industrial By Product for Sustainable Infrastructure Development	2,56,800		-	
Expert Group By Prof. Jayanta Bhattacharya on IIRRI of Automation Mineral Sector	93,991			
INAE Satish Dhawan Chair of Engineering Eminence	18,00,000		16,50,004	
INAE- Local Chapter Mumbai	1,119		35,268	
INAE- Local Chapter Bangalore	7,780		41,608	
INAE- Local Chapter Kolkata	-		26,972	
INAE- Local Chapter Pune	-		-	
INAE Awards		46,10,000		49,08,299
Life Time Contribution Award	10,00,000		10,00,000	
Young Engineer Award	15,00,000		17,09,451	
Young Entrepreneur Award	4,00,000		4,75,092	
Women Engineer Award	6,00,000		-	
Innovative Student Projects Awards	4,60,000		11,98,756	
Outstanding Teachers award	2,50,000		1,25,000	
Professor Jai Krishna Memorial Award	2,00,000		2,00,000	
Professor SN Mitra Memorial Award	2,00,000		2,00,000	
Academia- Industry Interaction Aicte-INAE Schemes		41,49,211		85,71,700
AICTE-INAE Distinguished Professorship Scheme	19,56,073		22,83,052	
AICTE- INAE Teaches Research Fellowship Scheme	18,11,500		27,04,000	
AICTE- INAE Travel Grant Scheme	3,81,638		35,84,648	
II. Forums		11,987		3,91,658
Forum on Technology Foresight and Management	11,987		75,889	
Forum on Disaster Risk Reduction	-		94,145	
Forum on Infrastructure	-		2,21,624	
Academy Meetings		80,621		35,13,365
Annual Convention		15,76,331		36,72,322
International Affairs		-		15,36,304
INAE Publications		3,49,598		15,51,779
Financial Assistance for Engineering activities		-		5,00,000
SERB-INAE Abdul Kalam Technology Innovation National Fellowship		418,73,909		274,01,615
INAE Digital Platform		9,62,355		84,134
Total		569,66,337		618,10,015



(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, 2021

SCHEDULE 22 - EXPENDITURE ON GRANTS, SUBSIDIES ETC.		Current Year 2020-21	Previous Year 2019-20
a) Grants given to institutions/ Organisations		-	-
b) Subsidies given to Institution/ Organisations		-	-
TOTAL		Nil	Nil
Note- Name of the Entities, their Activities along with the amount of Grants/ Subsidies to be disclosed			

SCHEDULE 23 - INTEREST		Current Year 2020-21	Previous Year 2019-20
a) On Fixed Loans		-	-
b) On Other Loans (including Bank Charges)		-	-
c) Interest accrued on DST Grants- added in unspent DST Grant		1,82,583	1,33,028
d) Interest accrued on SERB Grant for Abdul Kalam TIN Fellowship-added in unspent SERB Grant		2,34,904	93,885
e) Interest accrued on AICTE Grant for DVP Scheme-added in unspent AICTE-DVP Grant		1,89,957	-
f) Interest accrued on AICTE Grant for TG Scheme-added in unspent AICTE-TG Grant		40,338	-
TOTAL		6,47,782	2,26,913



(Signature)
(Bhuvvar Adhikha)
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

There are two types of Investments, one against Corpus and General Fund and the other against Earmarked Funds interest on which have been included in Income and Expenditure account and transferred to respective fund.

6. Gratuity & Leave Encashment

Provision for Gratuity is made as per the payment of Gratuity Act, 1972 and provision for accumulated leave and encashment has been made on the basis of no. 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. Contingent Liabilities claims against the entity not acknowledged as debts Rs. NIL (Previous year Rs. NIL)
2. Balance Sheet and Income and Expenditure account has 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. 1,87,296/- will be surrendered to DST for the year 2020-21 has been credited to Unspent DST Grant for further transfer of funds to Consolidated fund of India through Bharat Kosh.
4. Figures in Balance Sheet and Income and Expenditure Account have been given as applicable to INAE as per uniform format except Expenditure on Engineering programme and activities have been included in Income and Expenditure Account.
5. During the year ended March 31, 2021 a sum of Rs.3,00,000/- has been received from DST as Grant-in-aid towards capital asset creation and an unspent balance of Rs. 6,16,196/- was carried forward. Out of the said grant a sum of Rs.3,73,972/- has been utilized towards procurement of Fixed Assets/development of INAE Digital Platform there is a balance amount of Rs.5,42,224/- at the end of financial year 2020-21 which is carried forward to financial year 2021-22 along with interest Rs.4,109/- .
6. The balance of security deposits and some of 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.

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.




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8. Investment (others)- Term Deposit aggregating to Rs.9,57,00,000/- 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. 4,18,73,909/- on SERB- INAE Abdul Kalam Technology Innovation National Fellowship.
10. Figures are rounded off to Rupees.

For Jain Pramod Jain & Co.
Chartered Accountants
(FRN 016746 N)

On behalf of the Council:


President: 


(P.K.Jain)
Partner
Membership No. 010479



Vice-President: 
(Finance & Establishment)

Deputy Executive Director: 

Place: 
Date: 12 5 JUN 2021

Manager (F & A): 



INDIAN NATIONAL ACADEMY OF ENGINEERING, NEW DELHI
RECEIPT AND PAYMENT ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2021

	RECEIPT	Current Year 2020-21	Previous Year 2019-20	PAYMENTS	Current Year 2020-21	Previous Year 2019-20
I. Opening Balances				I. Expenses		
a) Cash In hand		18,793	3,056	a) Establishment expenses Sh. 20 as adjusted	153,29,502	238,37,151
b) Bank Balances		-	-	b) Administration expenses Sh. 21 as adjusted	38,33,007	47,93,581
i) In current accounts		-	5,58,085			
ii) In deposit accounts		845,00,000	945,00,000			
iii) savings Accounts		311,80,823	212,63,376			
II. Grants Received				II. Payments made against funds for various projects		
a) From Government of India				Engineering Programmes & Activities Sh. 21-A as adjusted	594,08,383	638,14,494
Revenue		403,00,000	461,84,000			
Capital		3,00,000	18,27,000			
b) From State Government		-	-	III. Investments and deposits made		
c) From other sources (details)				a) Out of earmarked/Endowment funds	-	-
Grant from Other Govt. Agencies		522,68,832	418,10,361	b) Out of Own funds (Investments- Other)	-	-
III. Income on Investments from				IV. Expenditure on Fixed assets & Capital Work-in-Progress		
a) Earmarked/ Endow funds		-	-	a) Purchase of Fixed Assets	3,73,972	12,10,804
b) Own Funds (Oth investment)		-	-	b) expenditure on Capital Work-in-progress	2,15,055	-
IV. Interest Received						
a) On Bank deposits		125,97,255	12,68,702	V. Refund of surplus money/Loans		
b) Loans, Advances etc.		-	-	a) To the Government of India	24,42,500	-
V. Other Income				b) To the State Government	-	-
Voluntary contribution/Sponsorship etc.		40,000	2,92,000	c) To other providers or funds	29,993	-
Foreign contribution		72,106	70,200		16,53,858	
Registration fees		-	65,000	VI. Finance Charges (Interest)		
Royalty on Publications		82,878	7,416	Interest remitted to DST through Bharat Kosh	1,33,051	2,33,788
VI. Amount Borrowed				VII. Other Payments (Specify)		
		-	-	TDS on incomes	3,95,774	6,33,169
VII. Any other receipts						
Refund of unspent balance by NCL Pune		-	4,44,867	VIII. Closing Balances		
Refund of unspent balance IIT Guwahati NATFOE 2018		-	3,49,494	a) Cash in hand	16,506	18,793
Refund of Income tax-TDS		8,06,811	9,36,451	b) Bank Balances		
Refund of unspent balance L&T EC 2018		-	13,720	i) In current accounts	-	-
TDS on Accrued interest		2,42,755	6,16,679	ii) In deposit accounts	957,00,000	845,00,000
Refund from IIT Patna- Abdul Kalam Scheme		17,33,333	-	iii) Savings accounts	451,66,766	311,80,823
Refund of unspent balance IIT Delhi Youth Conclave 2019		3,70,050	-			
Refund of unspent balance INAE Kolkata Chapter		1,80,411	-			
Refund of unspent balance Lalitha K- ISRO		4,304	-			
Misc. Receipts		16	12,196			
Total		2246,98,367	2102,22,603	Total	2246,98,367	2102,22,603

(Bhuwan Adhikaria)
Manager (F&A)

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