

E-Newsletter - Indian National Academy of Engineering (INAE)

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E-Newsletter

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New Year Message from President, INAE



Dr. Sanak Mishra

Esteemed Fellows of the Academy,

I am delighted to convey my New Year Greetings to you and to the Young Associates. May the New Year bring all the good things in life all of you richly deserve.

A time of new beginnings and fresh starts also comes with a time of reflections of the events of the year just gone by. To begin with, the year 2019 was embedded with number of achievements, and a number of fresh starts. I take this opportunity to highlight some of the salient ones. The year 2019 witnessed the launch and inauguration of INAE Digital Centre which was inaugurated by Prof. Ashutosh Sharma, Secretary, Department of Science & Technology (DST) on Feb 15, 2019 at Gurgaon. The aim of this Digital Centre is to digitize the existing schemes and activities of INAE and so far, twenty-two INAE modules have been digitized successfully.

Another major event that took place during year 2019 was the conduct of One-Day International Seminar on “Civil Aviation – Regional Air Connectivity” organized by INAE in association with the Ministry of Defence Production and Ministry of Civil Aviation as a part of Aero India on 21st February, 2019 at Bangalore. The seminar focussed on next generation regional turbo prop aircraft. Dr. VK Saraswat, Member, Niti Aayog was the Chief Guest and Ms. Vandana Aggarwal, Eco. Adviser, MOCA; Dr. Shekhar C Mande, DG, CSIR; Dr. G Satheesh Reddy, Chairman DRDO were the Guests of Honour. The event was a big success and well appreciated by concerned Ministries.

INAE also undertook initiative to organize a Workshop on “Imagining the Future of INAE” on August 8, 2019 wherein all Convenors/Reps of ten INAE Engineering Sections made a brief presentation elaborating the future of INAE, as envisaged by INAE Sectional Committees and the methodology to provide necessary leadership to accomplish the same.

As President of INAE, it has been always my prime motive to inspire INAE Local Chapters to undertake various activities under the umbrella of INAE, which could bring more visibility to INAE in different regions of the country. I take pride in informing that series of activities have been undertaken by various Local Chapters of INAE during year 2019. To list a few, INAE Bangalore Chapter organized India-USA Lecture Series (LS) on ‘Ageing Aircraft’ and related issues on November 27-29, 2019 at Bangalore; INAE Pune Chapter organized a seminar on ‘Engineering Complex Adaptive Systems with Digital Twins’ on November 7, 2019 at COEP, Pune; INAE Kharagpur Chapter organized a one-day Workshop on “Research in Steel Technology” on October 24, 2019 at IIT Kharagpur; INAE Mumbai Chapter jointly with IIT Bombay, Indian Institute of Chemical Engineers (IChE) and Indian Environmental Association (IEA), Mumbai, organized a One-Day National Workshop entitled: “Urban and Rural Challenges in Management of Solid Waste in India: A Circular Economy Approach to Building Smart Habitats” at IIT Bombay, Mumbai on September 24, 2019 and INAE Kolkata Chapter celebrated National Engineers Day on September 18, 2019 at the Gurukul Campus of the Institute of Engineering and Management, Kolkata.

Besides the above accomplishments of INAE during 2019; INAE has a mission of providing vital inputs to the planning for the country's development particularly related to engineering and technological content and depth. To achieve this mission, INAE undertakes a large number of technical activities organized annually.

One of the major such events of INAE is Engineers Conclave organized each year. The Seventh Engineers Conclave 2019 (EC-2019) was organized jointly with Bharat Electronics Limited (BEL) on Sept 19-21, 2019 at Bangalore on the two themes of "Defence Technology & Innovation" and "Transformation of Rural India Using Digital Technologies". Hon'ble Raksha Mantri Shri Rajnath Singh was the Chief Guest of the event.

Another step in the direction of promoting young engineers is to organize Symposium on National Frontiers of Engineering (NatFOE) each year, which brings together outstanding young engineers below 45 years of age from Academia, R&D and industry on a single platform to discuss leading – edge research and technical work across a range of engineering fields. The Thirteenth Symposium on National Frontiers of Engineering (13NatFoE) was held on May 31, 2019 to June 1, 2019 at IIT Bhubaneswar.

Another flagship event of INAE is the Youth Conclave which has been organized to promote the interaction between engineering students as upcoming momentum of engineering fraternity. The third INAE Youth Conclave was held in August 9-10, 2019 at IIT Delhi Main Campus. Prof. Anil D Sahasrabudhe, Chairman AICTE was the Chief Guest and Prof K VijayRaghavan, Principal Scientific Adviser to the Government of India was the Guest of Honor of this Conclave.

I would also like to inform that the 3rd INAE-NAEK (National Academy of Engineering Korea) Workshop on "High Temperature Materials and System Engineering for Aerospace, Power Generation and Defense Industry" was held during 15-17th July 2019 at Hyderabad. The workshop was jointly organized by INAE and Mishra Dhatu Nigam Limited, Hyderabad wherein twenty-four topics of mutual interest to India and Korea were covered. The Workshop was attended by 12 Korean and 53 invited Indian delegates. The workshop concluded with laboratory visits of the Korean delegation to MIDHANI, ARCI and BHEL R&D. The workshop brought immense appreciation from Dr. Oh-Kyong Kwon, President, NAEK.

I am very happy to share that INAE Annual Convention 2019 hosted by Birla Institute of Scientific Research during 12-14 December, 2019 was a grand success. The event started with inspirational Award Lectures by winners of Life Time Contribution Award in Engineering; Prof. Jai Krishna & Prof. SN Mitra Memorial Awards; and Outstanding Teachers Award held in the evening of December 12, 2019. The Convention was inaugurated by the Chief Guest, Mr. S. K. Roongta, Chairman, Bharat Aluminium Company Ltd. (BALCO) on December 13, 2019. The highlight of the event was three Plenary Lectures delivered by Dr. (Ms.) Varsha V. Bhosekar, Director, Central Water and Power Research Station, Pune, Mr. Manoranjan Ram, Associate Vice-President, SMS Group, Paul Wurth India Pvt Ltd., Gurgaon and Ms Pramita Mallick, renowned vocalist and exponent of "Rabindra Sangeet". The Convention brought immense appreciation from the invited dignitaries.

Throughout our activities in 2019, we received continuous encouragement and guidance from our former Presidents Dr. B. N. Suresh and Dr. P.S. Goel and I am much thankful to them.

While concluding this note, I would like to say that that we had an amazing year 2019 and hope to have another amazing year 2020 and, in this journey, I seek your support throughout in taking the Academy to greater peaks of vibrancy and success.

With best regards,

Dr. Sanak Mishra
President, INAE

We Welcome Lt Col Shobhit Rai (Retd) who has joined as Deputy Executive Director, INAE with effect from 06 January 2020



Lt Col Shobhit Rai (Retd)

Lt Col Shobhit Rai (Retd) has joined INAE as Deputy Executive Director with effect from 06 January 2020. He is an alumnus of National Defence Academy, Khadakwasla Pune, Jawaharlal Nehru University, Indian Institute of Technology Madras and Indian Institute of Management Ahmedabad. He is a Mechanical Engineer and has a Master's Degree in Biomedical Engineering. He served in the Indian Army from 1992 to 2013 in various technical and administrative capacities and is a specialist in Combat Vehicles and Biomedical Engineering. His last assignment in the Indian Army was with the Directorate General of Armed Forces Medical Services at Integrated Headquarters of Ministry of Defence as an advisor on Medical Equipment.

Since 2013, he worked in the Manufacturing Sector as a plant head with an automobile ancillary unit and has experience in high pressure aluminium die-casting and machining. He also has work experience in the Corporate Sector and was with Walmart India till 03 January 2020.

ACADEMY ACTIVITIES

Workshop on Future Landscape of Structural Materials in India (FLSMI)

The Workshop on Future Landscape of Structural Materials in India (FLSMI) was organized under the aegis of the INAE Forum on Indian Landscape of Advanced Structural Materials at Kolkata on December 7, 2019. A brief background on the subject is as follows: While manufacturing is a key component for sustainable economic growth of a nation, the success of manufacturing of structural goods or components heavily depend on designing, developing and exploiting the appropriate material. Materials for structural applications that offer a diverse range of mechanical properties are mostly a combination of several materials and are produced by multi-step manufacturing process. Moreover, the urge for improvement never ceases as both stringency of service condition and need for technological advancement continuously rise.

The seed was sown to initiate this initiative in April 2016, at an INAE Meeting, when it was decided that an authentic compendium will be published on Structural Materials in India under the aegis of the INAE Forum on "Indian Landscape of Advanced Structural Materials". It took another year and a half to work out the strategy and design a structure for the proposed book, with the chapter headlines and the relevant experts earmarked. The objective was to review the existing capability and readiness of the country to synthesise, develop and utilise advanced structural materials for the country's need.

The main structural materials identified for the study are advanced high strength steels, new generation aluminium alloys, Ti and Mg-based structural alloys, FRP composites and advanced ceramics. The concerned beneficiary sectors would be Defence, Aerospace, Railways, Power Generation and Automotive, all with a target of high strength, higher properties, longer service life and reliability. The stakeholder coverage however would include industry in each materials sector, industrial R&D, Government research laboratories, R&D laboratories of OEMs and academic institutes.

The Indian National Academy of Engineering (INAE) initiated a Technology Forum on "Indian Landscape of Advanced Structural Materials" in 2016 with Dr Debashish Bhattacharjee, VP, Tata Steel as the Convener of the Forum. The first meeting was held in Ahmedabad in Dec 2016, followed by two more in Kanpur in Jun 2017 and Kolkata in Nov 2018. Based on the deliberations in different fora at various levels and occasions spanning over the last three years, it is now planned to create an authentic report on the current status and future needs and trends in designing and developing advanced structural materials for various important industrial and strategic sectors of India. The collated review articles may be published as a peer reviewed compendium by a reputed publishing house. In this connection, INAE organized a one-day National Workshop in Kolkata on 7th Dec 2019 (Saturday) on "Future Landscape of Structural Materials in India (FLSMI)" in Hotel Pride Plaza, New Town, Kolkata. The workshop was inaugurated by Dr Sanak Mishra, President, INAE. Day long deliberations comprised 12 oral presentations followed by extensive interaction for 20-30 min each (including 3 by skype) by experts who would eventually submit chapters devoted to specific themes and help INAE create a comprehensive technology forecast and policy roadmap document for the nation.

The areas under focus are structural materials and components for Railways, Aviation, Space technology, Automobiles, Defense, Thermal power and atomic energy power plants, Refractories, Structural glass, Bio-medical prosthesis / implants, Carbon/graphene-based structures and design, Light metals (aluminium / titanium / magnesium based structural alloys), FRP composites and advanced ceramics.



Dr Sanak Mishra, President, INAE delivering his address as the Chief Guest



Prof Indranil Manna, Vice- President, INAE delivering talk on high temperature materials

The outcome of the study will be a report that will clearly highlight the following:

- (i) Current Indian scenario on development of advanced structural materials
- (ii) Gap with the rest of the world both in terms of volume and in terms of research and development
- (iii) Suggested actions that can be taken in terms of encouragement in research in certain areas through focused funding calls, or encouragement of start-ups and SMEs through intellectual and Government R&D support.

The workshop featured very interesting talks by eminent speakers and was a grand success.

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 Indian Nationals 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 upto two more years depending on the performance and the Fellowship can be held for a maximum of 5 years.

The scheme has received a good response and has gained visibility in the engineering community across the country. A maximum of 10 Fellowships are awarded in a year and six Fellowships were conferred in the Financial Year 2017-18 and eight in the Financial Year 2018-19. The INAE Governing Council during its meeting on December 12, 2019 at Birla Institute of Scientific Research (BISR), Jaipur, approved the names of seven nominees selected during the Financial Year 2019-20, as per details given below.

- i) Prof Rohit Srivastava, IIT Bombay
- ii) Prof Pushpak Bhattacharyya, IIT Patna
- iii) Prof V Kamakoti, IIT Madras
- iv) Prof Sujatha Srinivasan, IIT Madras
- v) Prof Subhananda Chakrabarti, IIT Bombay
- vi) Prof Bikramjit Basu, Indian Institute of Science, Bangalore
- vii) Prof Debatosh Guha, University of Calcutta, Kolkata

This would now make a total of twenty-one nominees who have been selected for conferment of the subject Fellowship since its inception.

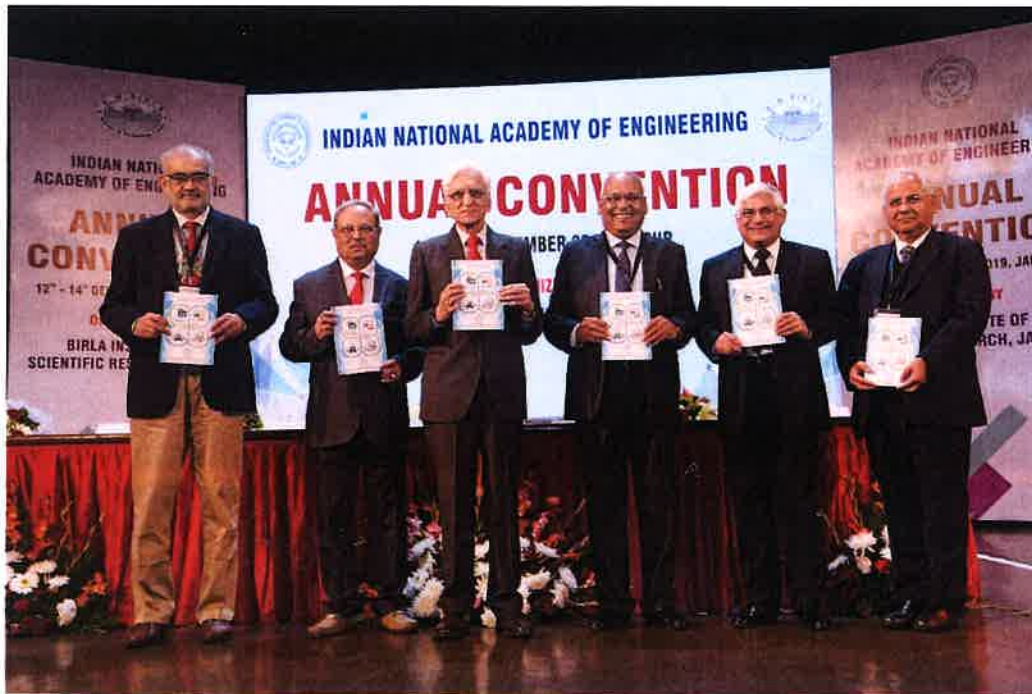
INAE Annual Convention 2019

The INAE Annual Convention 2019, hosted by Birla Institute of Scientific Research (BISR), Jaipur, from December 12 -14, 2019 and coordinated by Dr Purnendu Ghosh, Vice – President, INAE and Executive Director, BISR, Jaipur was held at BISR, Jaipur. All INAE Fellows and Young Associates had been invited to participate in the Annual Convention 2019. The Convention commenced with the INAE Governing Council Meeting on December 12, 2019 followed by the Award Lectures by the winners of Life Time Contribution Award in Engineering 2019 viz Prof EC Subbarao and Mr AS Kiran Kumar; Prof Jai Krishna Memorial Awardee - Prof KT Jacob; Prof SN Mitra Memorial Awardee- Prof RK Shevgaonkar and the INAE Outstanding Teacher Awardee- Prof BS Murty. After the Award Lectures, the INAE Fellows Dinner was held which provided an excellent opportunity for networking of Fellows.

The Inaugural Session of the INAE Annual Convention 2019 was held on December 13, 2019, which commenced with the lighting of the lamp by the dignitaries on the dais, followed by the rendition of a melodious invocation by the BISR team. The Welcome Address was delivered by Dr Purnendu Ghosh, Vice – President, INAE and Executive Director, Birla Institute of Scientific Research, Jaipur. Dr Sanak Mishra, President, Indian National Academy of Engineering (INAE) in his Presidential Address, gave an overview of the Academy and the major activities of the last one year. The highlight of the event was the inspiring talk delivered by the Chief Guest – Mr SK Roongta, Chairman, BALCO to the august audience. The book “Mind of an Engineer Volume II” edited by Dr Purnendu Ghosh released during the Inaugural Session is the second volume of a series of books featuring articles by INAE Fellows about the reminiscences, inspirations, challenges and opportunities in their professional journeys. The next feature of the Inaugural Session was the release of the Report on “Urban Transportation: Challenges and Way Forward” edited by Prof Prem Krishna, former Vice-President, INAE and Chairman, INAE Forum on Civil Infrastructure. The report comprises of an analysis of the challenges faced in the modernization of Urban Transportation and suggests solutions to overcome the same. This was followed by the Special Induction Ceremony of INAE Fellows from Industry wherein two stalwarts of industry viz. Mr SS Mohanty, Vice- Chairman cum Managing Director, Neelachal Ispat Nigam Limited and Dr Ramachandra Naidu Galla, Founder & Chairman, Amara Raja Group were inducted as Fellows of INAE. The Inaugural Session concluded with the proposing of the vote of thanks by Prof Indranil Manna, Vice-President, INAE.



Release of book “Mind of an Engineer Volume II”



Release of Report on “Urban Transportation: Challenges and Way Forward”

Three Plenary Talks were delivered during the Annual Convention by eminent personalities as per details below.

- First Plenary Talk on “Hydraulic Design of Water Resources Structures- Role of Model Studies” by Dr. (Ms.) Varsha V. Bhosekar, Director, Central Water and Power Research Station, Pune on December 13, 2019
- Second Plenary Talk on “Disruptive Innovations in Iron & Steel Industry” by Mr. Manoranjan Ram, Associate Vice-President, SMS Group, Paul Wurth India Pvt Ltd., Gurgaon on December 13, 2019.
- Third Plenary Talk on ‘Ecologically Yours: Tagore's Empathy with Environment’ by Ms Pramita Mallick, renowned vocalist and exponent of “Rabindra Sangeet” (the music of Tagore) on December 14, 2019

Technical Sessions were held on December 13, 2019 in which newly elected Fellows (whose Fellowship is effective from November 1, 2019) and INAE Young Engineer Awardees 2019 made presentations relating to their own significant engineering contributions.

The Grand Award Function was held on the evening of December 13, 2019, wherein Prof EC Subbarao and Mr AS Kiran Kumar were conferred the Life Time Contribution Award in Engineering 2019. Prof KT Jacob and Prof RK Shevgaonkar were conferred the Prof Jai Krishna Memorial Award and Prof SN Mitra Memorial Award 2019 respectively and Prof BS Murty was conferred the INAE Outstanding Teacher Award 2019. The awardees for INAE Young Entrepreneur Award 2019 were Mr. Suteerth Tripathi and Ms. Shivani Gupta, Inochi Care Private Limited, New Delhi and Mr. Prakhar Jain and Mr. Usama Ahmed Abbasi, MicroX Labs Pvt Ltd. Fifteen Young Engineer Awards 2019 were conferred to brilliant engineers below 35 year of age. The Innovative Student Project Awardees 2019 comprised of ten awards at Doctoral level; five at Master’s Level and ten at Bachelors Level who were presented for innovation in their project/thesis work. The Innovative Student Project Awardees 2019 and the team leaders of the INAE Youth Conclave 2019 competition award winning teams were also inducted as INAE Student Members during the Grand Award function. After the vote of thanks proposed by Dr Pradip, Vice- President, INAE a Cultural Programme was organized prior to the Dinner. The artists enthralled the audience with their entertaining performance.



Prof EC Subbarao being conferred with the Life Time Contribution Award in Engineering 2019



Mr AS Kiran Kumar being conferred with the Life Time Contribution Award in Engineering 2019



Prof KT Jacob being conferred the Prof Jai Krishna Memorial Award 2019



Prof RK Shevgaonkar being conferred the Prof SN Mitra Memorial Award 2019



Prof BS Murty being conferred the INAE Outstanding Teachers Award 2019



Dr Poulami Chakraborty being conferred the INAE Young Engineer Award 2019



Mr Suteerth Tripathi & Ms Shivani Gupta being conferred the INAE Young Entrepreneur Award 2019



Dr Gaurav Goswami being conferred the Innovative Student Project Award 2019

The session on lectures by the INAE Young Entrepreneur Awardees 2019 was held in the morning of December 14, 2019 wherein Mr Suteerth Tripathi delivered a lecture on “High performance multi-functional wound healing technology” and Mr Usama Ahmed Abbasi delivered a lecture on “Portable, efficient and affordable blood cell counter”.

The Annual General Meeting of Fellows was held on December 14, 2019 wherein during the Induction Ceremony, the newly elected Fellows and Young Associates were formally admitted into the Academy by the President, INAE. The was followed by the Special General Meeting of Fellows and the event concluded with lunch. A scenic tour of historical places, in and around Jaipur, was organized for the interested Fellows and Young Associates on December 15, 2019.



Group Photo with Newly Elected Fellows



Group Photo with INAE Young Associates

Welcome Meeting for Lt Col Shobhit Rai (Retd), Deputy Executive Director, INAE

A Welcome Meeting for Lt Col Shobhit Rai (Retd) who joined INAE Office as Deputy Executive Director was held on January 6, 2020 at INAE Office, Gurgaon. The meeting was presided over by Dr Sanak Mishra, President, INAE and was attended by the staff of INAE. Dr Sanak Mishra, President, INAE welcomed Lt Col Shobhit Rai (Retd) and felicitated him with the presentation of the Academy tie and a Memento and wished him a fruitful tenure at INAE.



Dr Sanak Mishra, President INAE welcoming Lt Col Shobhit Rai (Retd), Deputy Executive Director, INAE



Group Photograph with INAE Staff at Welcome Meeting

Academia Industry Interaction

AICTE-INAE Distinguished Visiting Professorship Scheme

Industry-academia interactions over technological changes have become essential in recent times so that relevant knowledge that would be sustainable in the changing conditions can be imparted to the students in the engineering institutions. While industries could gain by using the academia's knowledge base to improve the industry's cost, quality and global competitive dimensions; thereby reducing dependence on foreign know-how and expenditure on internal R&D, academics benefit by seeing their knowledge and expertise being fruitfully utilized practically and also by 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 a few lectures in engineering institutions. This scheme has become popular among industry experts as well as engineering colleges.

Brief details pertaining to recent visits of industry experts under this scheme are given below.

<p>Dr. Lalit Kumar, FNAE Former, Chairman CEPTAM, DRDO, New Delhi and Former, Director, MTRDC, DRDO, Bangalore</p>	<p>Dayananda Sagar Academy of Technology & Management, Bangalore</p> <p>Sept 26-28,2019</p> <p>Nov 4-6, 2019</p>	<p>Delivered lectures on "Introduction to Microwaves & Applications", "Klystron Tubes" and "Transmission Lines". As per the feedback received from the engineering college, the scheme has helped create a platform wherein experts from industry and academia exchange information. During this visit, several topics related to Microwave Engineering were presented in the lectures. The interactions of the Visiting Professor with the students helped them understand the intricacies and complexities of the Engineering Design process.</p> <p>Delivered Lectures on "Strip Lines", "High Power Microwaves for Security Applications" and "Micro Strip Lines". According to the feedback received from the college, the scheme has been very useful in enabling the students to understand the concepts and improve their knowledge. The interactions of the Visiting Professor with students motivated the students to undergo exploring learning. Students' knowledge on various topics of microwave engineering improved through learning beyond curriculum and industry exposure.</p>
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Dr. S Seetharamu, Director NDRF, Bangalore	Sahyadri College of Engineering & Management, Mangalore	Delivered lectures on "Future Technological Trends in Ceramic Materials" and "Recent Trends in Renewable Energy". As per the feedback received from the engineering college, the scheme provides a good opportunity for showcasing technology developments and current trends for students. The Visiting Professor has also helped guide projects and provided inputs for identifying new projects.
	Sept 20-21, 2019	
	Oct 24, 2019	Delivered lectures on "Condition Monitoring and Diagnostics of Thermal Power Plants" and "Recent Advances in Material Sciences". As per the feedback received from the engineering college, the scheme has been very useful in orienting the technical programs and project proposals through a networked interdisciplinary approach. The interactions of the Visiting professor with the faculty members on ongoing research projects and consultancy work have been very beneficial for the students.

Important Meetings held during December 2019

- **INAE Governing Council Meeting on December 12, 2019 at Birla Institute of Scientific Research (BISR), Jaipur.**
- **Annual General Meeting (AGM) of Fellows held on December 14, 2019 at Birla Institute of Scientific Research (BISR), Jaipur.**
- **Special General Meeting (SGM) of Fellows held on December 14, 2019 at Birla Institute of Scientific Research (BISR), Jaipur.**
- **Meeting of the INAE Forum on Civil Infrastructure held on December 17, 2019 at New Delhi.**
- **Meeting of the INAE Forum on Technology Foresight and Management held on December 26, 2019 at INAE Office, Gurgaon**

International/National Conferences/Seminars being organized by IITs/other Institutions

To view a list of International/ National Conferences/Seminars being held in the month of February 2020, click here....

Honours and Awards

1.	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 a Fellow of the Royal Society of Public Health in recognition of research contributions in Bioengineering/Physiological Fluid Dynamics that have promising impact on Public Health.
2.	Prof. Roddam Narasimha, FNAE, Chairman, Engineering Mechanics Unit, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore was one of the two scientists from India who received the 2019 Nature Awards for Mentoring in Science. Both the scientists earned praise from former trainees for prioritizing the success of their laboratory members over competition or a

publish-or-perish mentality, and for the joy they find in science. Nature's mentoring award programme, which in 2019 marked its 15th year, annual confers two prizes: one for a mid-career mentor, and other for a lifetime of achievement in mentoring. The 2019 awards sought nominations from India, a country that produced 24,300 PhD graduates in 2014, the fourth-highest number in the world after the United States, the United Kingdom and Germany. The nominations were judged by a panel that included Indians scientists working in the nation and abroad and each award had a prize of Rs 7 lakhs. Prof Roddam Narsimha, a fluid dynamicist received the Lifetime Achievement award.

News of Fellows

1. Mr RN Jayaraj, FNAE, Formerly Chairman & Chief Executive, Nuclear Fuel Complex, Department of Atomic Energy, Hyderabad has been chosen by Ministry of Electronics and Information Technology, Government of India for the Honorary Position of Chairman of "Research and Technology Committee" for development of Technologies for e-waste Management in the country. The Centre of Excellence for this task is being created at Hyderabad in the Campus of Centre for Materials for Electronics Technology (C-MET), Cherlapalli.

Obituaries

The Academy has learnt about the sad demise of the following INAE Fellows during the last six months. Deepest condolences are expressed to the families of the deceased Fellows on behalf of INAE and prayers are offered for their souls to rest in peace. Brief Obituaries as a mark of respect for the departed INAE Fellows are given below.

Dr Tuhin Kumar Roy

Dr Tuhin Kumar Roy, FNAE born on August 1, 1923 passed away on August 4, 2019.

Dr Tuhin Kumar Roy, FNAE Chairman, CMDC Design Pvt. Co. Ltd., New Delhi and Formerly Professor and Head, Chemical Engineering Department, Jadavpur University, Kolkata had made outstanding research contributions in the field of Chemical Engineering, covering the areas of Hydrometallurgy and Fluidization. His proactive efforts in the transfer of indigenously developed technologies to commercial scale, for utilization in Chemical Manufacturing Plants in India, are well recognized. As an inventor, he developed novel technologies and processes for recovery of nickel and cobalt from ore leach solutions for commercialization. He held several patents in India and USA in the fields of hydrometallurgy and chemical processes and published many research papers on reactions in fluidized bed, selective precipitation of metal powders and metallic sulphides and oxidative leaching of minerals. He had guided project work on coal processing plants including low temperature carbonization, formed coke and coal beneficiation. He had served as President of the Indian Institute of Chemical Engineers and the National Association of Consulting Engineers. In 2007, he was conferred with the Indian Institute of Chemical Engineers Diamond Award. Dr TK Roy had also contributed significantly to the activities and programmes of INAE and served as Honorary Treasurer from 1993 to 1995.

May God Bless his soul to Rest in Peace

Col BK Rai (Retd)

Col BK Rai, FNAE born on November 21, 1926 passed away on August 19, 2019.

Col BK Rai, FNAE, Formerly Chairman, UPTRON Group, HCL Ltd had made outstanding contributions in the growth of the Electronics Industry. His role in building up UPTRON from

scratch into a highly diversified and profitable venture is well recognized. The major areas of activity of UPTRON are: Computer and microprocessor-based systems; Computer communications; Radio and line communication systems; Office Automation; Mining control and communications; Process control and instrumentation; ground water electronic data logging; online computerised seat reservation systems for Air India and Indian Airlines; electrolytic capacitors; energy optimization systems and Black & White and colour picture tubes and low-cost Television and radios. Previously, he had held important positions in Air Headquarters and later joined the private sector. He also contributed towards identification of technologies for development of high technology products, of national importance, in industrially backward areas. He has trained senior personnel in technology and industrial management and helped nurture entrepreneurship in the Electronics field in remote areas.

May God Bless his soul to Rest in Peace

Prof AS Arya

Prof AS Arya, FNAE born on June 16, 1931 passed away on September 1, 2019.

Prof AS Arya, FNAE, Member, State Disaster Management Authority, Govt. of India and Formerly Seismic Capacity Building Advisor, Ministry of Home Affairs, Govt. of India-UNDP DRM Programme and Professor Emeritus, IIT Roorkee has made significant contributions in the field of Earthquake Engineering including formulation of the Codes of Practice and guidelines for earthquake resistant design and construction of buildings. He played a key role in developing indigenous expertise relating to earthquake disaster prevention and mitigation for structures ranging from multi-storeyed buildings, dams, nuclear power plants and petrochemical plants etc. He was instrumental in developing several courses in structural and earthquake engineering based on state-of-art in the subjects covering frontier areas of research. His innovative approach in developing laboratories for research were acclaimed and contributed significantly to conduct of experimental studies related to dynamic behaviour of masonry buildings and structures. All his life, he worked with zeal on implementation of seismic safety measures and was responsible for preparation of Vulnerability Atlas of India and Techno-legal Regime for Natural Disaster Reduction by Chairing of an Expert Group and helped create national awareness of disaster risk and safety practices and policies. Prof AS Arya was conferred with the Padma Shri Award by President of India and received the INAE Lifetime Contribution Award in Engineering in 2002.

May God Bless his soul to Rest in Peace

Prof Tarun K Ghose

Prof Tarun K Ghose, FNAE born on September 1, 1924 passed away on September 24, 2019.

Prof Tarun K Ghose, Founding Chair, Biochemical Engineering and Biotechnology, IIT Delhi was a pioneer in introducing biochemical engineering education and research in the country. He had made outstanding research contributions in the areas of Biotechnology and Biochemical Engineering including elucidation of the mode of formation of cellulase enzyme complex. He was recognized worldwide for his research work in the nineteen sixties on elucidation of the mode of formation and action of cellulase enzyme complex and its action on rapid saccharification of cellulose. This led to the development of what is known as "membrane reactor" for simultaneous reaction and separation of products of cellulose saccharification. His significant research contributions also covered areas of modelling, analysis and development of several optimal systems including strategy on dynamic control on rapid release of enzyme; analysis of immobilized cell bioreactor- a pioneering concept; rapid conversion of cellulose to ethanol and its separation by a

non-distillative route and development of a biphasic biomethanation process. Prof TK Ghose initiated the Department of food technology and biochemical engineering at Jadavpur University, H.B. Technological Institute, Kanpur, and Biochemical Engineering Research Centre at IIT Delhi. He was conferred with the INAE Life Time Contribution Award in Engineering in the year 2017.

Dr. VR Kanetkar

Dr VR Kanetkar, FNAE born on March 7, 1954 passed away on September 30, 2019.

Dr VR Kanetkar, Consultant- Technical Services, Autometers Alliance Ltd, Noida and formerly Assistant Vice -President, Corporate R&D, ABB Limited, Vadodara and Vice -President, Autometers Alliance Ltd had made significant research contributions in the areas of Power Electronics. He has several power electronic products and systems to his credit as a designer and most of these are from concept to commissioning including thyristorized DC drives, series parallel slip power recovery system, thyristorized reactive power compensators, semiconductor fuse-less design for thyristor converters, medium voltage thyristor converters, Elevator drive and insulated - gate bipolar transistor (IGBT) converter based Dynamic reactive power compensators. At ABB, Dr Kanetkar's responsibilities included development of electronic and power electronics products and systems necessary for Indian environment and customers. He provided support to the business areas on drives, traction, networks, automation, communication and relays in terms of analysis, simulation, guidelines for specific requirements, site problem solving, technical evaluations and studies and negotiations for orders. He contributed in major power electronics R&D work and implemented international standards for the functioning units of ABB. Dr VR Kanetkar translated his vast experience to Indian industries, Universities and Professional organizations.

May God Bless his soul to Rest in Peace

INAE on Facebook and Twitter

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>

International/National Conferences in February 2020

International Conference on Inventive Research in Material Science and Technology on 13th to 14th February 2020 at Coimbatore, Tamilnadu,
<https://conferencealerts.com/show-event?id=216344>

International Conference on Renewable Energy Integration into Smart Grids (ICREISG-2020) on 14th to 15th February 2020 at Bhubaneswar, Orrisa,
<https://conferencealerts.com/show-event?id=221404>

International Conference on Innovative Trends in Mechanical Electrical Electronics Civil Engineering, Computer Science (MECIT-2020) on 15th to 15th February 2020 at New Delhi.
<https://conferencealerts.com/show-event?id=222511>

International Conference on Chemical Bioprocess Textile Mining Engi. Energy Technologies & Environmental (TECHNOVA-2020) on 15th to 15th February 2020 at New Delhi,
<https://conferencealerts.com/show-event?id=222513>

IEEE International Conference on Inventive Computation Technologies on 26th to 28th February 2020 at Coimbatore, Tamilnadu
<https://conferencealerts.com/show-event?id=217380>

2nd International Conference on Advances in Mechanical Engineering and Nanotechnology on 28th to 29th February 2020 at Jaipur, Rajasthan,
<https://conferencealerts.com/show-event?id=218759>

Civil Engineering

1. Formula 1 Technology for The Construction of Skyscrapers

Researchers at City, University of London are developing new vibration-control devices based on Formula 1 technology so "needle-like" high-rise skyscrapers which still withstand high winds can be built. Current devices called tuned mass dampers (TMDs) are fitted in the top floors of tall buildings to act like heavyweight pendulums counteracting building movement caused by winds and earthquakes. But they weigh up to 1,000 tons and span five storeys in 100-storey buildings -- adding millions to building costs and using up premium space in tight city centres. Recent research work published by Dr Agathoklis Giaralis and his colleagues found that lightweight and compact inerters, similar to those developed for the suspension systems of Formula 1 cars, can reduce the required weight of current TMDs by up to 70%. Dr Giaralis said: "If we can achieve smaller, lighter TMDs, then we can build taller and thinner buildings without causing seasickness for occupants when it is windy. Such slender structures will require fewer materials and resources, and so will cost less and be more sustainable, while taking up less space and also being aesthetically more pleasing to the eye. In a city like London, where space is at a premium and land is expensive, the only real option is to go up, so this technology can be a game-changer." Tests have shown that up to 30% less steel is needed in beams and columns of typical 20-storey steel building thanks to the new devices. Computer model analyses for an existing London building, the 48-storey Newington Butts in Elephant and Castle, Southwark, had shown that "floor acceleration" -- the measure of occupants' comfort against seasickness -- can be reduced by 30% with the newly proposed technology. "This reduction in floor acceleration is significant," added Dr Giaralis. "It means the devices are also more effective in ensuring that buildings can withstand high winds and earthquakes. Even moderate winds can cause seasickness or dizziness to occupants and climate change suggests that stronger winds will become more frequent. The inerter-based vibration control technology we are testing is demonstrating that it can significantly reduce this risk with low up-front cost in new, even very slender, buildings and with small structural modifications in existing buildings." As well as achieving reduced carbon emissions through requiring fewer materials, the researchers can also harvest energy from wind-induced oscillations.

Source <https://www.sciencedaily.com/releases/2019/12/191209131952.htm>

2. Microchip capability expanded with new 3D inductor technology

Smaller is better when it comes to microchips, researchers said, and by using 3D components on a standardized 2D microchip manufacturing platform, developers can use up to 100 times less chip space. A team of engineers has boosted the performance of its previously developed 3D inductor technology by adding as much as three orders of magnitudes more induction to meet the performance demands of modern electronic devices. In a study led by Xiuling Li, an electrical and computer engineering professor at the University of Illinois, engineers introduce a microchip inductor capable of tens of millitesla-level magnetic induction. Using fully integrated, self-rolling magnetic nanoparticle-filled tubes, the technology ensures a condensed magnetic field distribution and energy storage in 3D space -- all while keeping the tiny footprint needed to fit on a chip. Traditional microchip inductors are relatively large 2D spirals of wire, with each turn of the wire producing stronger inductance. In a previous study, Li's research group developed 3D inductors using 2D processing by switching to a rolled membrane paradigm, which allows for wire spiraling out of plane and is separated by an insulating thin film from turn to turn. When unrolled, the previous wire membranes were 1 millimeter long but took up 100 times less space than the traditional 2D inductors. The wire membranes reported in this work are 10 times the length at 1 centimeter, allowing for even more turns -- and higher inductance -- while taking up about the same amount of chip space. "A longer membrane means more unruly rolling if not controlled," Li said. "Previously, the self-rolling process was triggered and took place in a liquid solution. However, we found that while working with longer membranes, allowing the process to occur in a vapor phase gave us much better control to form tighter, more even rolls." Another key development in the new microchip inductors is the addition of a solid iron core. "The most efficient inductors are typically an iron core wrapped with metal wire, which works well in electronic circuits where size is not as important of a consideration," Li said. "But that does not work at the microchip level, nor is it conducive to the self-rolling process, so we needed to find a different way." To do this, the researchers filled the already-rolled membranes with an iron oxide nanoparticle solution using a tiny dropper. "We take advantage of capillary pressure, which sucks droplets of the solution into the cores," Li said. "The solution dries, leaving iron deposited inside the tube. This adds properties that are favourable compared to industry-standard solid cores, allowing these devices to operate at higher frequency with less performance loss." Though a significant advance on earlier technology, the new microchip inductors still have a variety of issues that the team is addressing, Li said. As with any miniaturized electronic device, the grand challenge is heat dissipation which is being addressed.

Source <https://www.sciencedaily.com/releases/2020/01/200123152609.htm>

3. Revolutionary Reversible 4D Printing

Imagine having your curtains extended or retracted automatically without needing to lift a finger? Reversible 4D printing technology could make these 'smart curtains' a reality without the use of any sensors or electrical devices, and instead rely on the changing levels of heat during the different times of the day to change its shape. 4D printing essentially refers to the ability of 3D printed objects to change its shape over time caused by either heat or water while the reversibility aspect of it allows it to revert to its original shape. However, to have it change back to its original shape usually requires the manual stretching or pulling of the object, which can be laborious and time consuming. In recent years, there have been successful breakthroughs in the study of reversible 4D printing, where the object gets back its original shape without any human intervention. This usually involved the use of hydrogel as a stimulus to achieve reversible 4D printing. As hydrogel lacks mechanical strength, it became a limitation when used for load-bearing applications. At the same time, other research work that utilised various layers of material as an alternative to hydrogel, only made the procedure to enable reversible actuation more tedious. To address these challenges, researchers from the Singapore University of Technology and Design collaborated with Nanyang Technological University to revolutionise 4D printing by making it reversible, without the need for hydrogel nor human interference. This research work utilised only two materials, VeroWhitePlus and TangoBlackPlus, which were more readily available and compatible for printing in a 3D polyjet printer compared to using a hydrogel. The researchers also proved in their paper that the materials were able to retain considerable mechanical strength during and after actuation. The process consisted of the swelling of elastomer with ethanol to replace the function of hydrogel swelling to induce stress on the transition material. When heated, the transition material changes its shape to a second shape. After the ethanol is being dried out of the elastomer, heating the transition material again will then allow it to revert to its original shape, as the elastomer will pull the transition material back due to elastic energy stored in it after drying. The elastomer plays a dual function in this whole process. It is used to both to induce stress in the programming stage and to store elastic energy in the material during the recovery stage. This process of reversible 4D printing has also proven to be more precise when the material reverts to its original shape compared to manually stretching or inducing stress on it. While it is still in its infancy, this breakthrough development provides a wide variety of applications in the future when more mechanisms and more materials become available for printing.

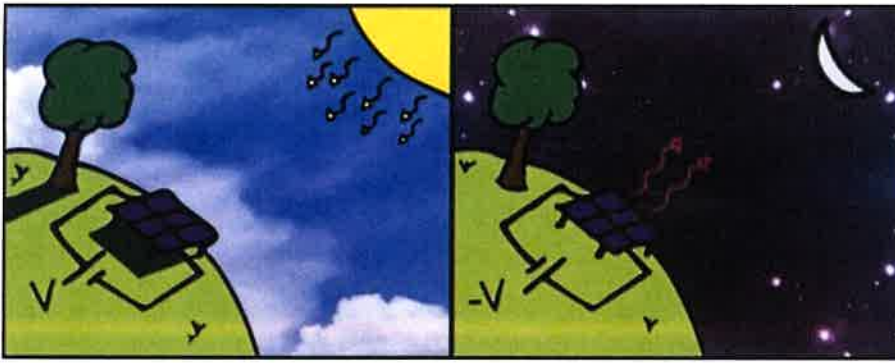
Source <https://www.sciencedaily.com/releases/2020/01/200129091409.htm>

4. Lab Turns Trash into Valuable Graphene in a Flash

A new process introduced by the Rice University lab of chemist James Tour can turn bulk quantities of just about any carbon source into valuable graphene flakes. The process is quick and cheap; Tour said the "flash graphene" technique can convert a ton of coal, food waste or plastic into graphene for a fraction of the cost used by other bulk graphene-producing methods. The world throws out 30% to 40% of all food, because it goes bad, and plastic waste is of worldwide concern. The researchers have already proven that any solid carbon-based matter, including mixed plastic waste and rubber tires, can be turned into graphene. Flash graphene is made in 10 milliseconds by heating carbon-containing materials to 3,000 Kelvin. The source material can be nearly anything with carbon content. Food waste, plastic waste, petroleum coke, coal, wood clippings and biochar are prime candidates. A concentration of as little as 0.1% of flash graphene in the cement used to bind concrete could lessen its massive environmental impact by a third. Production of cement reportedly emits as much as 8% of carbon dioxide every year. "By strengthening concrete with graphene, we could use less concrete for building, and it would cost less to manufacture and less to transport," he said. "Essentially, we're trapping greenhouse gases like carbon dioxide and methane that waste food would have emitted in landfills. We are converting those carbons into graphene and adding that graphene to concrete, thereby lowering the amount of carbon dioxide generated in concrete manufacture. It's a win-win environmental scenario using graphene." Graphene acts both as a 2D template and a reinforcing agent that controls cement hydration and subsequent strength development. The process aligns nicely with Rice's recently announced Carbon Hub initiative to create a zero-emissions future that repurposes hydrocarbons from oil and gas to generate hydrogen gas and solid carbon with zero emission of carbon dioxide. The flash graphene process can convert that solid carbon into graphene for concrete, asphalt, buildings, cars, clothing and more, Tour said. Flash Joule heating for bulk graphene, developed in the Tour lab improves upon techniques like exfoliation from graphite and chemical vapor deposition on a metal foil that require much more effort and cost to produce just a little graphene. Even better, the process produces "turbostratic" graphene, with misaligned layers that are easy to separate. "A-B stacked graphene from other processes, like exfoliation of graphite, is very hard to pull apart," Tour said. "The layers adhere strongly together. But turbostratic graphene is much easier to work with because the adhesion between layers is much lower. They just come apart in solution or upon blending in composites. "That's important, because now we can get each of these single-atomic layers to interact with a host composite," he said. The flash process happens in a custom-designed reactor that heats material quickly and emits all noncarbon elements as gas. "When this process is industrialized, elements like oxygen and nitrogen that exit the flash reactor can all be trapped as small molecules because they have value," Tour said. The flash process produces very little excess heat, channeling almost all of its energy into the target. All the excess energy comes out as light, in a very bright flash, and because there aren't any solvents, it's a super clean process. Atom-level simulations by Rice researcher confirmed that temperature is key to the material's rapid formation. "We essentially speed up the slow geological process by which carbon evolves into its ground state, graphite," a researcher said. "Greatly accelerated by a heat spike, it is also stopped at the right instant, at the graphene stage.

Source <https://www.sciencedaily.com/releases/2020/01/200127134751.htm>

5. Anti-Solar Cells: Thermoradiative Photovoltaic Cells Work at Night



A conventional photovoltaic or solar cell (left) absorbs photons of light from the sun and generates an electrical current. A thermoradiative cell (right) generates electrical current as it radiates infrared light (heat) toward the extreme cold of deep space. UC Davis engineers propose that such cells could generate a significant amount of energy and help balance the power grid over the day-night cycle.

What if solar cells worked at night? Jeremy Munday, professor in the Department of Electrical and Computer Engineering at UC Davis designed photovoltaic cell could generate up to 50 watts of power per square meter under ideal conditions at night, about a quarter of what a conventional solar panel can generate in daytime. Munday, is developing prototypes of these night-time solar cells that can generate small amounts of power. The researchers hope to improve the power output and efficiency of the devices. Munday said that the process is similar to the way a normal solar cell works, but in reverse. An object that is hot compared to its surroundings will radiate heat as infrared light. A conventional solar cell is cool compared to the sun, so it absorbs light. Space is very cold, so if you have a warm object and point it at the sky, it will radiate heat toward it. People have been using this phenomenon for night-time cooling for hundreds of years. In the last five years, Munday said, there has been a lot of interest in devices that can do this during the daytime (by filtering out sunlight or pointing away from the sun). There's another kind of device called a thermo-radiative cell that generates power by radiating heat to its surroundings. Researchers have explored using them to capture waste heat from engines. "We were thinking, what if we took one of these devices and put it in a warm area and pointed it at the sky," Munday said. This thermo-radiative cell pointed at the night sky would emit infrared light because it is warmer than outer space. "A regular solar cell generates power by absorbing sunlight, which causes a voltage to appear across the device and for current to flow. In these new devices, light is instead emitted and the current and voltage go in the opposite direction, but you still generate power," Munday said. "You have to use different materials, but the physics is the same." The device would work during the day as well, if you took steps to either block direct sunlight or pointed it away from the sun. Because this new type of solar cell could potentially operate around the clock, it is an intriguing option to balance the power grid over the day-night cycle.

Source <https://scitechdaily.com/anti-solar-cells-thermoradiative-photovoltaic-cells-work-at-night/>

6. First All-Optical, Stealth Encryption Technology Developed

BGN Technologies, the technology-transfer company of Ben-Gurion University of the Negev (BGU), Israel, is introducing the first all-optical "stealth" encryption technology that will be significantly more secure and private for highly sensitive cloud-computing and data centre network transmission. Time is running out on security and privacy of digital encryption technology, which can be read offline if recorded and code-broken using intensive computing power. The researchers developed an end-to-end solution providing encryption, transmission, decryption, and detection optically instead of digitally. Using standard optical equipment, the research team essentially renders the fibre-optic light transmission invisible or stealthy. Instead of using one colour of the light spectrum to send one large data stream, this method spreads the transmission across many colours in the optical spectrum bandwidth (1,000 x wider than digital) and intentionally creates multiple weaker data streams that are hidden under noise and elude detection. Every transmission -- electronic, digital or fibre -- has a certain amount of "noise." The researchers demonstrated that they can transmit weaker encrypted data under a stronger inherent noise level that cannot be detected. The solution also employs a commercially available phase mask, which changes the phase of each wavelength (colour). That process also appears as noise, which destroys the "coherence" or ability to recompile the data without the correct encryption key. The optical phase mask cannot be recorded offline, so the data is destroyed if a hacker tries to decode it. "Basically, the innovative breakthrough is that if you can't detect it, you can't steal it," Prof. Sadot – the lead researcher says. "Because an eavesdropper can neither read the data nor even detect the existence of the transmitted signal, our optical stealth transmission provides the highest level of privacy and security for sensitive data applications." The novel, patented method invented by Prof. Sadot and his team is highly useful for multiple applications, such as high-speed communication, sensitive transmission of financial, medical or social media-related information without the risk of eavesdropping or jamming data flow. In fact, with this method, an eavesdropper will require years to break the encryption key. "Every data centre has 100G and 400G lines, and part of those lines are encrypted end-to-end," Prof. Sadot adds. "There is the need for non-digital encryption for customers who require the most advanced security possible."

Source <https://www.sciencedaily.com/releases/2020/01/200129091411.htm>

7. ISRO's GSAT-30 Satellite Launched, to Replace Ageing INSAT-4A



A view of GSAT30 communication satellite

GSAT-30, for DTH television services, broadband operations, has been launched from Kourou on January 17, 2020. The nation's latest communication satellite, GSAT-30, was sent to space from the Guiana Space Centre in Kourou at 2:35 a.m. IST on Friday, January 17, 2020. The 3,357-kg satellite will replace INSAT-4A which was launched in 2005 and marks the first mission of the year for Indian Space Research Organisation. The high-power satellite is equipped with 12 normal C band and 12 Ku band transponders. GSAT-30 will provide DTH (direct to home) television services, connectivity to VSATs (that support working of banks') ATMs, stock exchange, television uplinking and teleport services, digital satellite news gathering and e-governance applications. The satellite will also be used for bulk data transfer for a host of emerging telecommunication applications. Its unique configuration provides flexible frequency segments and flexible coverage. The satellite will provide communication services to Indian mainland and islands through the Ku band and wide coverage over Gulf countries, a large number of Asian countries and Australia through the C band. In a flight lasting over 38 minutes, European Ariane-5 space vehicle VA-251 released GSAT-30 in an initial elliptical geosynchronous orbit. The ISRO Master Control Facility (MCF) picked up its signals immediately and found its systems okay. Over the next few weeks, MCF engineers gradually adjusted it into a final circular orbit 36,000 km from earth and apparently fixed at 83° East longitude over the country. ISRO hired a foreign launcher as GSAT-30 is much heavier than the 2,000-kg lifting capacity of its geostationary launch vehicle GSLV-MkII. A consortium led by Alpha Design Technologies Ltd. assembled GSAT-30 at the ISRO Satellite Integration & Test Establishment in Bengaluru.

Source <https://www.thehindu.com/news/national/isros-gsat-30-satellite-launched-successfully-to-replace-ageing-insat-4a/article30582116.ece>

8. Nano-Thin Flexible Touchscreens Could Be Printed at Home – 100x Thinner Than Current Technology



New touch-responsive technology is 100 times thinner than existing touchscreen materials and so pliable it can be rolled up like a tube. Researchers have developed an ultra-thin and ultra-flexible electronic material that could be printed and rolled out like newspaper, for the touchscreens of the future. The touch-responsive technology is 100 times thinner than existing touchscreen materials and so pliable it can be rolled up like a tube. To create the new conductive sheet, an RMIT University-led team used a thin film common in cell phone touchscreens and shrunk it from 3D to 2D, using liquid metal chemistry. The nano-thin sheets are readily compatible with existing electronic technologies and because of their incredible flexibility, could potentially be manufactured through roll-to-roll (R2R) processing just like a newspaper. Lead researcher Dr. Torben Daeneke said most cell phone touchscreens were made of a transparent material, indium-tin oxide, that was very conductive but also very brittle. They took an old material and transformed it from the inside to create a new version that's supremely thin and flexible. The material can be bent, twisted and you could make it far more cheaply and efficiently than the slow and expensive way that we currently manufacture touchscreens. "Turning it two-dimensional also makes it more transparent, so it lets through more light. This means a cell phone with a touchscreen made of our material would use less power, extending the battery life by roughly 10%." The current way of manufacturing the transparent thin-film material used in standard touchscreens is a slow, energy-intensive and expensive batch process, conducted in a vacuum chamber. The new approach doesn't require expensive or specialized equipment. Researchers showed that it is possible to create printable, cheaper electronics using ingredients you could buy from a hardware store, printing onto plastics to make touchscreens of the future. To create the new type of atomically-thin indium-tin oxide (ITO), the researchers used a liquid metal printing approach. An indium-tin alloy is heated to 200C, where it becomes liquid, and then rolled over a surface to print off nano-thin sheets of indium tin oxide. These 2D nano-sheets have the same chemical make-up as standard ITO but a different crystal structure, giving them exciting new mechanical and optical properties. As well as being fully flexible, the new type of ITO absorbs just 0.7% of light, compared with the 5-10% of standard conductive glass. To make it more electronically conductive, you just add more layers. The research team have now used the new material to create a working touchscreen, as a proof-of-concept, and have applied for a patent for the technology. The material could also be used in many other optoelectronic applications, such as LEDs and touch displays, as well as potentially in future solar cells and smart windows.

Source <https://scitechdaily.com/nano-thin-flexible-touchscreens-could-be-printed-at-home-100x-thinner-than-current-technology/>

9. Safe Potassium-Ion Batteries

Australian scientists have developed a non-flammable electrolyte for potassium and potassium-ion batteries, for applications in next-generation energy-storage systems beyond lithium technology. Scientists write that the novel electrolyte based on an organic phosphate makes the batteries safer and allows for operation at reduced concentrations, which is a necessary condition for large-scale applications. Lithium-ion technology still dominates energy-storage applications, but it has intrinsic disadvantages, among which are the price, environmental issues, and the flammability of the electrolyte. Therefore, in next-generation technologies, scientists are replacing the lithium ion with more abundant and much cheaper ions, such as the potassium ion. However, potassium and potassium-ion batteries also face safety issues, and non-flammable electrolytes are not yet available for them. Materials scientist Zaiping Guo, and her team from the University of Wollongong, Australia have found a solution. The researchers developed an electrolyte based on a flame-retardant material and adapted it for use in potassium batteries. Besides providing nonflammability, it could be operated in batteries at concentrations that are suitable for large-scale applications, write the scientists. This novel electrolyte contained triethyl phosphate as the sole component of the solvent. This substance is known as a flame retardant. It has been tested in lithium-ion batteries, but only very high concentrations provided enough stability for long-term operation, too high for industrial applications. The battery industry demands dilute electrolytes, which are cheaper and ensure better performances. By using potassium ions, however, the concentrations could be reduced, the authors reported. They combined the phosphate solvent with a commonly available potassium salt and obtained an electrolyte that did not burn and allowed stable cycling of the assembled battery concentrations of 0.9 to 2 moles per litre, which are concentrations that are suitable for larger scales; for example, in smart-grid applications. Key to that performance was the formation of a uniform and stable solid-electrolyte interphase layer, according to the authors. They observed this layer, which ensures operability of the electrodes, only with the phosphate electrolyte. Conventional carbonate-based electrolytes were unable to build up this layer. The authors also reported high cycling stability; whereas, under the same conditions, the conventional carbonate-based electrolyte decomposed. The research team have demonstrated that next-generation potassium-ion batteries can be made safe by using a novel inorganic, phosphate-based electrolyte. They suggest that electrolytes based on flame retardants can be developed further and could be used for the design of other non- flammable battery systems.

Source <https://www.sciencedaily.com/releases/2020/01/200131114739.htm>

10. 'PigeonBot' is the First Robot that Can Bend its Wings Like a Real Bird



Pigeons have found greater value in these urban birds as the blueprint for a new generation of flying machines. Birds can modify the shape of their wings by fanning out their feathers or shuffling them closer together. Those adjustments allow birds to cut through the sky more nimbly than rigid drones. Now, using new insights into exactly how pigeons' joints control the spread of their wing feathers, researchers have built a robotic pigeon, dubbed PigeonBot, whose feathered wings change shape like the real deal. This research paves the way for creating more agile aircraft. With birdlike wings, airborne machines could make tighter turns in cluttered spaces, such as around buildings or in forests, and could better navigate rough air. Researchers bent and extended the wings of dead pigeons to investigate how the birds control their wing shape. Those experiments revealed that the angles of two wing joints, the wrist and the finger, most affect the alignment of a wing's flight feathers. The orientations of those long, stiff feathers, which support the bird in flight, help determine the wing's shape. Based on those findings, the team built a robot with real pigeon feathers, whose faux wrists and fingers can morph its wing shape as seen in the pigeon cadavers. Birds like pigeons change the shape of their wings mid-flight by bending their wrist and finger joints to fold their wing feathers closer together or spread them farther apart. Those adjustments help birds pull tight turns and manoeuvre through turbulence. A pigeon could steer itself just by bending the finger joint of either its left or right wing. A controllable robotic pigeon has been developed. In flight tests, the research team observed that bending only the finger of one wing eased the robot into a banked turn -offering the first evidence that birds may sometimes use just their fingers to steer in flight. With two bendable joints, wrist and finger, the wings of a new robotic pigeon can bend into different shapes. The group used their robotic wing design to confirm another insight into bird flight: how gaps are prevented from forming between feathers on extended wings. In experiments that involved rubbing one bird feather across the top of another -to mimic overlapping flight feathers fanning out -researchers found that two feathers initially slid apart easily, but then snagged on each other. Scanning electron and X-ray microscopy images revealed that tiny hooks protruding from the top of one feather latch onto ridges on the underside of the other when they slide too far apart. Those microscopic hooks unfasten when the feathers slot back together. "That's the secret. They have this directional Velcro" that holds feathers together, the lead researcher says. A robotic pigeon that can change its wing shape like a real bird paves the way for creating more agile aircraft and offers a new way to study bird flight. To confirm the effect of these microstructures, the researchers rotated the feathers on their robot so that they wouldn't slide against each other when wings were extended. In wind tunnel and outdoor flight tests, gaps formed between feathers on the modified robot wings, undermining the wings' stability. This is the best set of robotic wings yet for testing how birds coordinate their flight feathers to manoeuvre through the air. A future flying robot could include a shoulder joint, to investigate how tilting a bird's wings up and down influences flight, engineers say.

Source <https://www.sciencenews.org/article/new-robot-pigeon-can-bend-wings-like-real-bird>

Engineering Innovation in India

IIT Kharagpur Develops AI-Powered Tech for reading Legal Cases

Researchers from IIT Kharagpur's Computer Science and Engineering department have developed two deep neural models to understand the rhetorical roles of sentences in a legal case judgment, which could prove phenomenal in India where Artificial Intelligence (AI) is yet to sufficiently penetrate the legal field. Researchers at IIT Kharagpur have evolved an Artificial Intelligence-aided method to automate the reading of legal case judgments, the premier institute said in a statement issued in January 2020. The country uses a Common Law system that prioritises the doctrine of legal precedent over statutory law, and where legal documents are often written in an unstructured way. "Taking 50 judgments from the Supreme Court of India, we segmented these by first labelling sentences with the help of three senior law students from IIT Kharagpur's Rajiv Gandhi School of Intellectual Property Law, then performing extensive analysis of the human-assigned labels and developing a high quality gold standard corpus to train the machine to carry out the task," explained research lead Professor Saptarshi Ghosh. Unlike earlier attempts which required substantial human intervention, the neural methods used by Prof Ghosh's team enables automatic learning of the features, given sufficient amount of data, and can be used across multiple legal domains. This method can help in several downstream tasks such as summarisation of legal judgments, legal search, case law analysis, and other functions. In certain countries, Artificial Intelligence is being used to perform legal research, review documents during litigation and conduct due diligence, analyse contracts to determine whether they meet pre-determined criteria, and to even predict case outcomes. Prof Ghosh and his team are using network and text analysis to understand if two legal documents are similar. "We are trying to build an AI system which can give guidance to the common man about which laws are being violated in a given situation, or if there is merit in taking a particular situation to court, so that legal costs can be minimised," he said. The project is being supported by the Science & Engineering Research Board (SERB) of the Department of Science and Technology, Government of India, under the project, 'NYAYA: A Legal Assistance System for Legal Experts and the Common Man in India'.

Source <https://www.hindustantimes.com/education/iit-kharagpur-develops-ai-powered-tech-for-reading-legal-cases/story-JF6Qt7lvAOB7h61518glUO.html>