

Indian National Academy of Engineering



Annual Report - 2011-12

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Foreword

I have the pleasure of presenting the Annual Report of INAE to you. This has been a momentous year as the Academy is celebrating Silver Jubilee. The Academy has implemented a number of purposeful programmes and activities. The Annual Report provides exclusive information on the activities during the year. Thus, I do not intend to catalogue these programmes in my message. The year also witnessed a quantum increase of activities in the areas of collaboration with foreign academies. We are pursuing focussed themes with the Chinese Academy of Engineering, Canadian Academy of Engineering, the Royal Academy of Engineering, UK and the Australian Academy of Technological Sciences and Engineering, in domains of mutual interest. During the year under review, study reports in domain of healthcare, water, infrastructure, R&D in industry, etc. have been released by the Academy, which marks a new dimension in the activities of INAE. The INAE Forums are progressing in their work and new forums are being created to charter new paths for the Academy to contribute to the country and the world. I also wish to share with you a good news that INAE would be hosting the Committee of Academies of Engineering & Technological Sciences (CAETS) Annual Assembly in 2015. We shall choose the theme of the Annual Assembly, in a year or so. Please send your suggestions for the theme, so that we can arrive at the good theme, in consultation with BODs of CAETS.

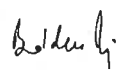
India, with unique opportunities and obstacles while achieving progress, provides challenges for the Academy to redefine herself in the context of changing times. INAE must connect to the decision makers and all the stake holders, in particular to all the citizens of the country. The Academy, with reservoir of high quality competence and capacity, must provide timely unbiased analysis and recommendations for changes in education, implementation of infrastructure, energy mix changes, technology management with foresight, ethics and equity, etc.

It is in this context that the Academy is continuously rediscovering and redefining the programmes and activities, taking advantage of the silver jubilee year to introspect and make a bold befitting perspective. The challenge of the Academy is not only to be innovative and relevant but also be a catalyst in enhancing relevance and impact of our recommendations.

It can be perceived that we in India, know and analyse with rigour, but do not implement with synergy our strategies and action plans. I would like to invite, suggestions from the fellows, of the Academy to provide impetus and momentum to our national progress beyond the much debated parameters of GDP, inflation, deficits, etc. (all essential parameters) on issues of sustainability, bridging a variety of divides in our society, ensuring harvesting of demographic dividends, enhancing the pace of achieving equity and ethics, etc. I have thought over these issues, over a long period and I believe choice of technologies and technology management have a role to play in these vital challenges relating to growing India.

I have been greatly encouraged by the participation and commitment of our fellows, collaborations with foreign academies of engineering and keen desire of policy makers to involve the academy to give independent considered views and recommendations.

I look forward to your continued support and guidance.


Dr. Baldev Raj
 President

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 such fields as may be necessary for comprehensive solutions to the needs of the country.

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

1. To promote and advance the practice of engineering and technology and the related sciences and disciplines and their application to problems of national importance.
2. To disseminate information on all matters pertaining to 'Engineering' by publishing proceedings, journals, memoirs and by holding meeting, lectures, seminars, symposia, etc.
3. To interact with professional bodies, engineering and scientific academies, etc. already established or as may be established in future in India and abroad.
4. To represent at all academic forums, research and development activities on 'Engineering' in India and abroad.
5. To promote the National Policy on Education of the Government of India.
6. To offer the Government of India, the Local Governments and others, facilities for conferring with and ascertaining the views of 'Engineers' pertaining to 'Engineering' and to confer with the said Governments and others in cooperation with fraternal professional bodies
7. To encourage inventions, investigations and research and promote their applications for development of both organised and unorganised sectors of the national economy.
8. To institute and establish Professorship, Fellowship, Studentship, Scholarship, Awards and other benefactions and to grant Certificates of Competency and Charter whether under any Act of Government of India or otherwise howsoever.

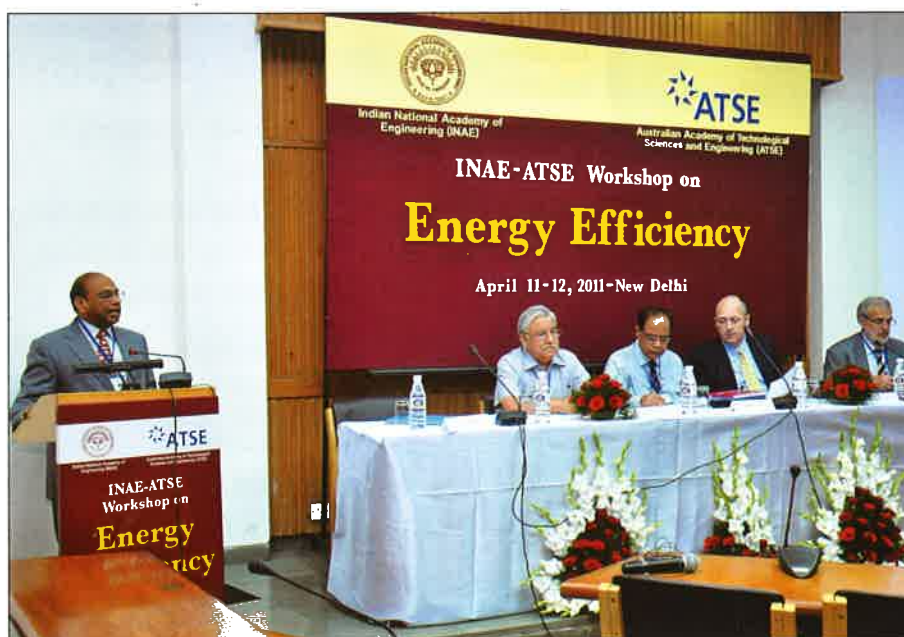
Seminars/Conferences

INAE-ATSE Workshop on “Energy Efficiency”

INAE-ATSE Workshop on Energy Efficiency was jointly organized by Indian National Academy of Engineering (INAE) and Australian Academy of Technological Sciences and Engineering (ATSE) on April 11-12, 2011 at India International Centre, New Delhi. Dr. Ajay Mathur, FNAE, Director General, Bureau of Energy Efficiency, New Delhi was the workshop Chair from INAE and Mr. Martin Thomas, FTSE was the workshop Chair from ATSE. Both India and Australia face common challenges in managing energy losses in power generation and in buildings, and energy efficiency upgradation of coal power plants and the development of thermal comfort specifications in buildings emerged as important areas of common interest between the two countries. The objective of the workshop was to bring together Australia and Indian energy technology and policy experts to identify the key issues and strategies towards Australia and India meeting future energy efficiency needs.

The session themes of the workshop were as follows:— Energy Efficiency in Power Generation - Imperatives & Policy Directives; Energy Efficiency in Power Generation - Roadmap for Development & Adoption of New Coal-Based Power Generation Technologies; Energy Efficiency in Power Generation - Enhancing Efficiency of Existing Power Stations; Energy Efficiency in Buildings - Imperatives and Policy Directives; Energy Efficiency in Buildings - Design of New Buildings; Energy Efficiency in Buildings - Retrofitting of Existing Buildings and a Concluding Session.

Experts from the two countries discussed the challenges in the development of advanced technologies for power stations, upgrading the existing energy efficiency of power stations, design and construction of very-efficient new buildings, and energy retrofits in existing buildings. Both India and Australia face common challenges in managing energy losses in power generation and in buildings, and energy efficiency upgradation of coal power plants and the development of thermal comfort specifications in buildings emerged as important areas of common interest between the two countries.



*Dr. Ajay Mathur, FNAE,
Director General, Bureau of
Energy Efficiency, New Delhi
addressing the participants*

The participants included leading engineers and policy makers from India and Australia, and the large commonality of interests were identified. Dr. Baldev Raj, President, INAE and former Director, IGCAR, Kalpakkam emphasized the range of possibilities of collaboration, including materials development for high energy efficiency systems in coal power generation and photovoltaic power generation. Further, in view of the challenge of implementing low carbon growth strategies in both countries, the need to exchange experience and information was also emphasized. Other areas of common interest included joint assessment of gasifier based coal power generation, and of nuclear power; methodologies for the development and evaluation of performance based energy efficiency rating systems for buildings; and intelligent grid and smart metering pilots to enable integration of wind and solar power in the grids.

Mr. Martin Thomas, Co-Chair, ATSE Energy Forum and Chairman, Dulhunty Power Pty Ltd, Australia has emphasized enhanced interaction between ATSE and INAE so as to help the prioritization and implementation of the strategic areas of interest identified at the Workshop.

The Workshop focused on experiences and opportunities for the two Academies to collaborate in areas of energy-efficiency enhancement in the power generation and the buildings sectors. A Joint Statement was signed by the Presidents of INAE and ATSE and a range of opportunities were identified for Australia-India collaboration. The following strategic areas were identified for Academy-to-Academy collaboration:

- (a) Performance enhancement of existing power plants
 - Technology and best practices for energy efficiency upgrades
 - Coal blending and coal performance modeling
- (b) New technologies for power generation
 - Hybrid gasification – solar heat systems
 - Advanced coal technologies, such as fuel cells and coal-powered diesel engines
 - Carbon capture and utilization
- (c) Distributed generation management
 - Intelligent grids, including smart metering, optimal decision making and renewables integration
 - Efficient grid-scale inverters
- (d) Building energy efficiency
 - Implementation, compliance and evaluation of performance-based rating system for new buildings
 - Development of thermal comfort conditions in warmer climates and its applications
- (e) Building energy efficiency upgrade
 - Creation of demand for building-energy efficiency upgrade
- (f) Building energy-efficiency technology development
 - Innovative space conditioning technologies

Consequent to above, as a first step towards follow up actions, the areas of renovation of power stations and the design of energy efficient buildings have been chosen during May 2011 for further collaborative activities between the two academies.

Prof. CS Jha Memorial Seminar on “Effective Engineering Teaching/ Pedagogy and Technology Interface”

Prof. CS Jha Memorial Seminar on “Effective Engineering Teaching/Pedagogy and Technology Interface” held on April 16, 2011 at IIT Delhi was co-sponsored by INAE. The objective of the

seminar was to address the challenges in the area of engineering education and evolving suitable remedies. Prof. SS Murthy, FNAE in his theme presentation highlighted that late Prof. CS Jha was a pioneer in engineering education and a role model who emphasized on the quality of teaching and the importance of good curricula and laboratory training. He was a great visionary and had held the positions of Director, IIT Kharagpur and Vice Chancellor, Banaras Hindu University and was a Foundation fellow of INAE. The theme of the seminar was to address new challenges such as attracting, cultivating and retaining good teachers; improving the effectiveness of teaching learning programmes and increased use of ICT. The Golden Jubilee award of IIT Delhi presented to Prof. CS Jha (posthumously) was received by Smt. Rajshri Jha.

This was followed by the inaugural address by Dr. K Kasturirangan, FNAE, Member, Planning Commission. He paid tribute to Prof. CS Jha by calling him a doyen of engineering education. He mentioned that there are challenges in the area of engineering education system and one should not just look at the islands of excellence like IITs but at the broader picture in terms of the entire country and the issues of quality, standards and competitiveness in creating a knowledge economy. India has had a consistent economic growth rate and its development is linked to the technological advancement for which we need a large number of world class engineers. He emphasized that we must not compromise in terms of quality and there are several ways to address this challenge. He mentioned that EDUSAT, a satellite dedicated to education is a way of reaching the masses in this vast country and providing them the benefit of quality education. The impact of EDUSAT was positive and several beneficial programmes were designed keeping in view the language and specific needs of different regions of the country. He suggested that this system should be scaled up for wider outreach and benefit. Engineering education plays a major role and educational technology tools including ICT is one such solution. Prof. Surendra Prasad, Director IIT Delhi in his address praised Prof. Jha as being a teacher par excellence and an academic leader whose insights were enlightening and inspiring to students and teachers alike. He brought out that a teacher is a facilitator of the teaching-learning process.

Sixth National Frontiers of Engineering Symposium (NatFOE6)

The Sixth National Symposium on National Frontiers of Engineering (NatFOE 2011), the flagship event of the Indian National Academy of Engineering (INAE), was organized at Indian Institute of Technology Hyderabad, between September 2-3, 2011. The symposium was attended by nearly 100 participants including 17 distinguished speakers and 29 invited participants who came from all over the country.

The symposium was inaugurated by lighting of the lamp by the dignitaries followed by welcome speech by Prof. U. B. Desai. He thanked INAE for giving an opportunity to host this prestigious event at IIT Hyderabad and emphasized that the theme of this year's symposium "Green Technologies" was chosen in such a way to cover most of the engineering disciplines so that a multidisciplinary approach may be adopted for this emerging area. In his opening remarks, Dr. MJ Zarabi, Vice-President, INAE, emphasized that these conclave of young



engineers should lead to some tangible ideas that require to be further evolved into specific project proposals and pursuing thereafter in a timely manner. This, of course, would require someone amongst the interested researchers to act as a champion for the project. This was followed with an address by Chief Guest Dr. PS Goel. He advised all young engineers to adopt a unified approach to develop technologies which can benefit the society directly.

The Inaugural Function was followed by two plenary talks by Dr. Ashok Misra, former Director, IIT Bombay and Prof. Juser Vasi, IIT Bombay. Prof. Ashok Mishra talked about Green Chemistry and related areas. He suggested that lower energy and fuel consumption and minimization of waste along with designing safer chemicals and reuse of feedstock are the major challenges of green chemistry. Prof. Vasi emphasized on the need of developing highly efficient solar cells for grid connector applications. He said that Si based solar cells may be a cost-effective approach to energy consumption.

The post lunch programme on day one comprised of keynote lectures, panel discussion and a session on industrial initiative towards Green Technologies. Following keynote lectures were delivered in two parallel tracks as below:

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| (a) <i>Green ICT</i> | Dr. G Venkatesh, <i>Sasken</i> ; Prof. YN Srikant, <i>IISc Bangalore</i> ; Dr. Girija Narlikar, <i>Core Athena Systems</i> and Lt. Gen. V Sundaram. |
| (b) <i>Green Structures</i> | Dr. SK Bhattacharyya, <i>Director CBRI Roorkee</i> ; Dr. Manamohan R Kalgal, <i>UltraTech Cement Ltd.</i> ; Prof. KVL Subramainiam, <i>IIT Hyderabad</i> and Dr. M Amaranath Reddy, <i>IIT Kharagpur</i> . |

The panel discussion was attended by six young engineers. Panelists were Dr. Sapatrisi Majumdar, IIT Hyderabad, Dr. S Sireesh, IIT Hyderabad, Dr. Pranesh Sengupta, BARC, Dr. R Ramjee, IIT Ropar, Dr. Bhaushan Jagyasi, TCS Innovation Labs, Mumbai and Dr. Jitendra Sangwai, IIT Madras. They discussed on R&D in Green Technologies: Needs and Expectations of Young Researchers.

On the second day the following keynote lectures were delivered under two parallel tracks

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| (a) <i>Green Energy</i> | Prof. Rangan Banerjee, <i>IIT Bombay</i> ; Dr. Akanksha Chaurey, <i>TERI</i> and Dr. Shivkumar Kalyanaraman, <i>IBM</i> . |
| (b) <i>Green Material and Processes</i> | Prof. Shyam Asolekar, <i>IIT Bombay</i> and Prof SV Kailas, <i>IISC Bangalore</i> . |

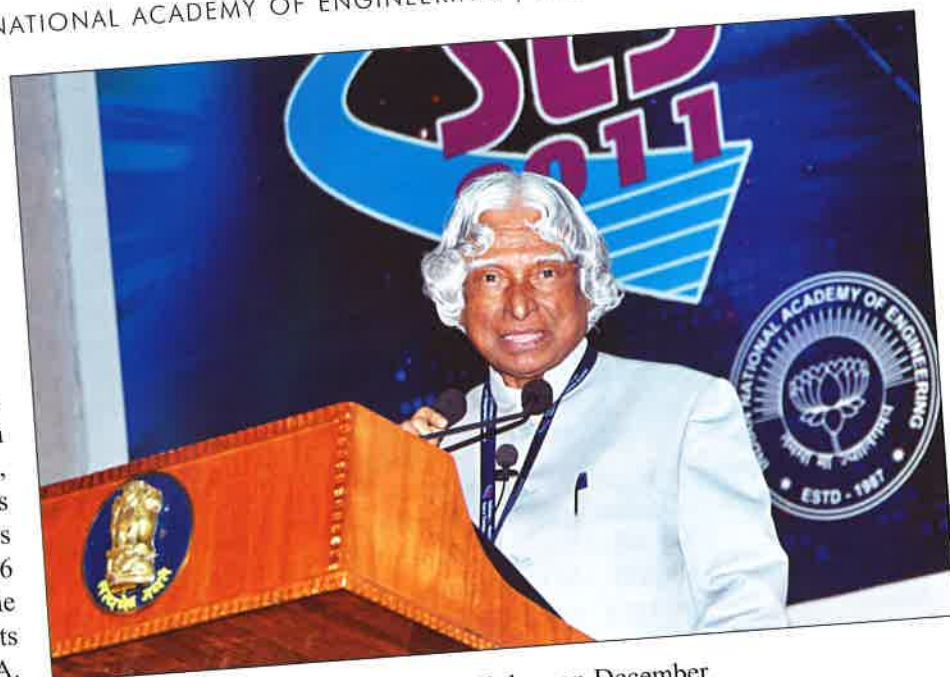
The invited lectures were delivered by Dr. Preeti Aghalayam, IIT Madras, Dr. SK Bhaumik, National Aerospace Laboratories, Bangalore and Dr. Muthukumar, IIT Guwahati.

Through focused presentations and discussions, the participants shared, learnt and appreciated the international and national state-of-the-art practices on four themes viz. Green ICT, Green Structures, Green Energy and Green Material and Processes. The speakers addressed engineering problems of national importance in these and related fields. The presentations were followed by excellent interactive sessions. The symposium was a great success since it provided a platform which initiated brainstorming discussions between the lead speakers and the young engineers from Academia, R&D and Industry with the aim of tackling several challenging problems. The participants' over all response was overwhelming.

National Conference on "Space Transportation Systems: Opportunities and Challenges"

National Conference on Space Transportation Systems: Opportunities and Challenges held on December 16-18, 2011 at Vikram Sarabhai Space Centre, Thiruvananthapuram was jointly organized by Indian National Academy of Engineering (INAE) and Vikram Sarabhai Space Centre (VSSC), ISRO. The three days of the conference provided a platform for eminent experts in the field of

Dr. APJ Abdul Kalam delivering the Inaugural Address



aerospace and space transportation to come together and share their wisdom with the participating engineers, scientists, technocrats, academicians and industrialists. The participants included 680 registered delegates, 36 invited speakers and other guests. The invited speakers included six experts from NASA, ESA, JAXA and MPDA.

The conference was inaugurated by former President of India Dr. A P J Abdul Kalam on December 16. The inaugural function was preceded by the screening of special video documentaries depicting the strides India has undertaken in the field of space technology and transportation systems. Shri P S Veeraraghavan, Director, VSSC/ISRO and Chairman, Organizing Committee welcomed the delegates and guests. Dr. Baldev Raj, President, INAE delivered the presidential address. Dr. Radhakrishnan, Chairman, ISRO delivered a special address. Shri S Ramakrishnan, Director, LPSC/ISRO introduced the conference theme. Dr. Kalam, in his keynote address, elaborated on World Space Vision 2050, the challenges facing the space community in the decades ahead as well as on the use of space to mitigate the impending global energy crisis. The conference publications were released during the inaugural ceremony by Dr. T K Alex, Director, ISAC/ISRO. The publications included a souvenir which contained the abstracts of all technical papers selected for the conference, a CD containing the proceedings and an exhibitors' directory. Shri M C Dattan, Director, SDSC/ISRO offered felicitations. Smt J. Geetha, Organising Secretary, offered a vote of thanks to all the participants.

A host of sessions on wide ranging topics related to Space Transportation systems were kick-started after the inaugural function. In line with the theme of the conference, eleven plenary sessions were organized featuring national and international experts in the field elaborating on the state of the art as well as the challenges and highlighting the opportunities in the road ahead.

Prof. U R Rao, former Chairman, ISRO addressed a plenary session on Scientific Drivers for Advanced Space Transportation Systems. Dr. K Radhakrishnan, Chairman, ISRO spoke about Emerging Space Applications – Drivers for Space Transportation. The topic Transportation System for Human Space Missions was covered by Dr. B N Suresh, Former Director, VSSC. Dr. Guy Pichen, ESA explained about Opportunities and Challenges of European Next Generation Launcher. R&T efforts in France & Europe for High Speed Air Breathing Propulsion Technology and its application to Space Launcher was the topic elaborated by Dr. Francois Falempin, MBDA. Dr. Takumi Ujino, JAXA spoke on JAXA's Space Transportation Systems: H-28 Project Status and Next Generation Systems. Strategies at NASA for Knowledge Sharing and lessons learned was the theme of the speech of Dr. Edward J Hoffman, NASA, while Dr. John Olson, NASA spoke on NASA's Space Exploration Program: 2011 and Beyond. Prof. Hitoshi Kurinaka, JAXA explained about Round-trip Mission of Hayabusa Asteroid Explorer – Dawn of Space Exploration Era. Other plenary sessions featured Shri P S Veeraraghavan, Director, VSSC speaking on Evolution of Space Transportation Systems – World Scenario and Shri Pramod Kale, Former Director, VSSC speaking

on Opportunities to Smaller Communication and Earth Observation Satellites.

95 technical papers were presented in 22 technical sessions organized on specific areas covering the entire gamut of Space Transportation Systems and Technology. Six parallel sessions were conducted at different venues. Each technical session featured invited talks by eminent experts in the field elaborating on key topics, followed by the presentation of papers. In addition, 75 papers were presented as posters. Some of the areas focused upon in the technical sessions include Expendable & Reusable Launch Vehicles, Advanced Propulsion concepts for Launch Vehicles, Space craft systems and Planetary Sciences. Emerging technologies in different areas were highlighted including navigation, guidance, control, space materials, avionics systems, power systems, fabrication, aerospace structures, etc. Papers were presented on human presence in space, launch space environment, life support systems, sensors and mission planning, Discussions on Commercialization of Space and Space Medicine also featured in the sessions. A major exhibition showcasing the great strides made by the nation in the field of aeronautics and space transportation was also organized at the venue. The exhibition titled STS EXPO 2011 was inaugurated by Dr. K Radhakrishnan, Chairman, ISRO during the inaugural function. Thirty exhibitors including HAL, KMMML, AVDL Aerospace, Centum Electronics and Ankit Fasteners put up impressive stalls. VSSC put up a special pavilion and there was a stall dedicated to student projects.

The concluding session on 18 December featured a panel discussion. The panel was chaired by Dr. S C Gupta and the panelists comprised of distinguished experts in different areas of space transportation systems including many of plenary session speakers. Dr. P S Goel, Shri Pramod P Kale, Shri P S Veeraraghavan, Shri S Ramakrishnan, Prof. B N Raghunandan, Shri M C Dattan, Shri Rakesh Sharma, Shri R V Perumal and Dr. K Narayana were among the panelists. The panel discussed the deliberations of the conference and evolved recommendations for future course of actions. The discussions were enriched by the active participation by the erudite audience.

MOS-AK/GSA India 2012-International Workshop on Device Modeling of Microsystem

MOS-AK/GSA India 2012 - International Workshop on Device Modeling of Microsystems was organized by INAE during March 16-18, 2012 at Noida. Prof. AB Bhattacharyya, Emeritus Professor, Jaypee Institute of Information Technology, Noida was the Chair of the workshop. This workshop was supported by Department of Information and Technology (DIT) and sponsored by major industries like IBM, Austriamicrosystems, Texas Instruments, Mentor Graphics, Cadence, Freescale, STMicroelectronics and others.

The aim of this Workshop was to provide a Hi-Tech forum to discuss the frontiers of device modelling for Microsystems with emphasis on simulation-aware models.

This event envisaged to strengthen a network and discussion forum among experts in the field, enhance open platform for information exchange related to compact/spice modeling and Verilog -A standardization, bring people in the compact modelling field together, as well as obtain feedback from technology developers, circuit designers, and CAD tool vendors. The topics covered all important aspects of compact model development, implementation, deployment and standardization within the main theme - frontiers of the compact modelling for CMOS/SOI circuit simulation and nm-scale MEMS designs.

The specific workshop goal was to classify the most important directions for the future development of the microelectronic device models, not limiting the discussion to compact models, but including physical, analytical and numerical models, to clearly identify areas that need further research and possible contact points between the different modelling domains. This workshop was designed for device process engineers (CMOS, SOI, BiCMOS, SiGe) who are interested in device modelling; IC designers (RF/Analog/Mixed-Signal/SoC) and those starting in that area as well as

device characterization, modelling and parameter extraction engineers.

The workshop also was envisaged to serve as a platform for launch of MOS-AK/GSA India which forum will help galvanize the micro-electronics modelling community in India.

Five technical sessions followed by a Tutorial on CMOS Technology and SPICE Models were held on the third day. Ten posters presentations were made on the relevant topics. About 100 delegates from industry, R&D and academia participated in this workshop. Participation included industries like IBM, Texas

Instruments, Austriamicrosystems, etc., R&D labs from DAE, CSIR and DRDO and academia like IIT, IIIT, NIT, CDAC, SMDP institutions all over the country. 20 speakers including 10 from overseas delivered talks during the workshop. The eminent speakers from abroad who presented papers were : Mitiko Miura-Mattausch, Hiroshima University, Japan; Narain D. Arora, Silterra, Malaysia ; Yogesh Chauhan, UC Berkeley, USA; Xing Zhou, NTU, Singapore; Andre Juge (STM), France; Samar Saha, University of Colorado, USA ; Wladek Grabinski, MOS-AK/GSA, EU; Mike Brinson, London Metropolitan University, UK; Thomas Gneiting, ADMOS, Germany; and Yogesh Chauhan, UC Berkeley, USA.



Academia-Industry Interaction

AICTE-INAE Distinguished Visiting Professorship Scheme

Academia and industry, which for long have been operating in separate domains, are rapidly moving closer to each other to create synergies. Academic institutes now place great importance to closer interaction with industry and R&D organizations. The Indian National Academy of Engineering (INAE) launched a Distinguished Visiting Professorship (DVP) scheme jointly with AICTE in 1999. The Scheme envisages promotion of industry-institute interaction by facilitating the dissemination of knowledge through the expertise of experienced and knowledgeable persons from industry to integrate their rich industrial experience with technical education. As per the objectives of the scheme; the Distinguished Visiting Professor is to required to deliver lectures on the state-of-art of industry, industrial ambience and R&D needs of the industry to the students and faculty of technical institutions; guide student projects/theses of interest to industry; help curriculum development, keeping in view, the changing industrial needs; develop cooperative undergraduate and postgraduate programmes with industry having potential benefits to faculty, students and industry and take up any other activities for the mutual benefit of engineering institutions and industry.

The scheme has no doubt been a great success and has been running effectively during the last twelve years. Thirteen industry experts were selected during the year 2000; eighteen each in 2001 and 2002; fourteen in 2003; ten in 2004; thirteen in 2005; thirteen during the year 2006, fifteen during 2007; eleven during 2008; eighteen during the year 2009 and nine during the year 2010 by a high level Steering Committee of INAE Fellows from academia, industry and representatives from AICTE and CII. The industry experts selected under the subject scheme include experts from industry as well as DRDO/DAE/DOS labs. During their visits, the visiting professors besides delivering lectures on the state-of-art industrial practices and sharing their industrial experience with the faculty/students of the affiliated engineering institutions are also assisting in updating the curriculum. There is no doubt that both the industry and engineering institutions are the beneficiaries of academia-industry interaction. The outcomes of this interaction are industry support to basic research; industry participation in technology development involving exploratory work and academic intervention in solving specific industry problems.

A meeting of the Steering Committee on AICTE-INAE Distinguished Visiting Professorship Scheme was held on May 24, 2011 to discuss fifteen nominations received for the year 2011-2012. Out of these, the following seven were selected.

1. Prof. SK Bhattacharyya, Director, CBRI, Roorkee
2. Dr. B Nageswara Rao, Scientist 'G', Vikram Sarabhai Space Centre (VSSC), Trivandrum
3. Dr. Shantanu Chakrabarti, Head, Research Applications, Tata Steel R&D, Jamshedpur
4. Dr. PV Bala Subramanyam, Additional Director, Central Power Research Institute (CPRI), Bangalore

5. Capt. NS Mohan Ram, Adviser, TVS Motor Company Ltd., Hosur
6. Dr. M Arunachalam, Senior Specialist (EE), BHEL, Bangalore
7. Dr. N Gowrishankar, Director, IP Rings Ltd., Maraimalar Nagar, Tamil Nadu

The tenure of thirty industry experts, selected earlier and are currently visiting various engineering colleges/institutions, was extended for a further period of one year.

There is a constant endeavour to improve and strengthen the functioning of the scheme for which suggestions/views are sought from the industry experts as well as affiliated engineering colleges/institutions through a Feedback Report after each visit by the industry expert. All relevant suggestions made from time to time are reviewed to ensure that necessary follow-up actions are taken. The scheme has been running successfully and has received good response from industry as well as engineering colleges/institutions. Review Meetings are held regularly each year. Last Review Meeting was held on April 23, 2011 at IIT Madras, Chennai in which the concerned industry experts as well as heads of affiliated engineering colleges/institutions participated and suggestions regarding further improvement and strengthening of the scheme were discussed.

Some of the representative feedbacks received recently from engineering colleges/institutions associated with this scheme are given below.

- (a) *The interactions of the industry expert with the faculty and doctoral students were beneficial to the research programmes.* – Head, Department of Metallurgical Engineering, AU College of Engineering (Andhra University), Visakapatnam
- (b) *The interaction with the industry expert is a great value addition to the training in our academic institution.* – Head, Department of Civil Engineering, National Institute of Technology Karnataka, Surathkal
- (c) *The scheme is very good for better interaction between academic institutes and industry and such interactions should take place on regular basis for the benefit of the students and the faculty.* – Head, Metallurgical and Materials Engineering Department, Jadavpur University, Kolkata

International Affairs

19th CAETS Convocation and Annual Meeting

The CAETS (International Council of Academies of Engineering and Technological Sciences) Council Meeting and Convocation on “Engineering Analysis and Management to Reduce Risks” hosted by Mexican Academy of Engineering was held during June 27-July 1, 2011 at Mexico City. INAE delegation comprising Dr. Baldev Raj, President, Dr. MJ Zarabi, Vice-President, Dr. P Chellapandi, IGCAR, Kalpakkam, Prof. Sudhir K Jain, IIT Gandhinagar and Brig SC Marwaha, Executive Secretary attended this event.

CAETS Board of Directors meeting was held on June 27, 2011. This meeting was attended by members of CAETS Board of Directors – four office bearers (President-elect, President, Past President and Secretary/Treasurer) and eight additional members from the member academies as per Rotation List. Dr. Baldev Raj, who is one of the members of the CAETS Board of Directors during the current year, attended this meeting and highlighted the importance of creation of an Asian Academy Forum to focus on challenges and opportunities in Asia. He mentioned that this Forum would be in the framework of CAETS and in fact will strengthen the initiatives and activities of CAETS. He also emphasized the importance of working with International Council for Science (ICSU). India will participate in both these Forums.

CAETS Convocation on “Engineering Analysis and Management to Reduce Risks” was held during June 28-30, 2011. In the context of this Convocation, “Risk” was defined as an event that if it occurs, it will have a negative (or sometimes positive) and substantial impact on the environment and its inhabitants. The impact of the risk can be reduced by different means, namely, designed-in elements that direct, deflect, slow down, resist, contain, the matters that cause damage and early preparation to reduce losses and speedy recovery. A third dimension is post-occurrence and is directed to salvage, damage control and recovery. In all these dimensions of risk, engineering is a key player. During the Convocation, a number of diverse actions to reduce risks were deliberated upon considering four areas of concern, viz., hydrological related risks, mostly flooding; seismic related risks; man caused risks, focused on oil and gas; and the new set of skills that engineering must develop to appropriately meet the challenges presented by the ongoing climate change.

The programme for the Convocation was balanced with presentations, Panel Discussions and Q&A Sessions. These presentations included “Health monitoring and asset management to mitigate risks in high technology applications” by Dr. Baldev Raj; “Robust approaches in design, manufacturing, operation and regulatory practices in the context of risk minimization” by Dr. P Chellapandi and “The Road to Seismic Safety with particular reference to the developing countries” by Prof. Sudhir K Jain.

CAETS had constituted a Working Group for a project on “Deployment of Low Emissions Technologies for Electric Power Generation in response to Climate Change” during the year 2009. This Working Group comprised of ATSE, acatech, Canadian Academy of Engineering, INAE, Engineering Academy of Japan, South African Academy of Engineering and the Royal Academy of Engineering, UK. The Working Group submitted its Report last year. Based on suggestions and positive response from the members, this Working Group was tasked to undertake the Second Phase of the Study on “The Challenges facing Low-Carbon Energy Technologies for Power

*CAETS Council
meeting in progress*

Generation to 2050". A draft report prepared by this Working Group was discussed during a meeting held on June 27, 2011 at Mexico on the sidelines of CAETS Convocation, in which representatives from Australia, Canada, Germany, India, Korea, UK and South Africa participated. Dr. Baldev Raj, Dr. MJ Zarabi and Brig SC Marwaha attended this meeting. Dr. Baldev Raj briefed about the status of solar energy in India and initiatives undertaken for encouraging low

carbon technologies. He highlighted that in India, efforts are ongoing to develop India-centric technologies which are low carbon and hybridized with renewable or stand-alone system. Research, development and deployment for new technologies and new sources of energy have become more effective in mission-mode projects with long-term commitment. The ultimate goal of the deployment programme is to bring research stage technologies to markets, through a process of 'learning' to overcome the market barriers and through targeted programmes of market transformation. He iterated that no single policy alone triggers a robust renewable energy market. Rather, a portfolio of policies is needed to address different types of barriers and establish a stable market and this has been the line of Indian Government policy initiative through Ministry of New and Renewable Energy.



CAETS Council meeting was held on July 1, 2011. Besides the administrative actions and issues, brief presentations were made regarding the reports prepared by CAETS Committees on International Organisations (CIO) and CAETS Noise Control Technology Committee (NCTC).

CAETS had given distinctive honour to INAE, Royal Academy of Engineering, UK and the Danish Academy of Technical Sciences (ATV) to lead a discussion on the relationship between their Academies and the respective National Governments. Dr. Baldev Raj brought out that the interaction of INAE with the Government is carried out through various activities of the Academy. These include preparation of policy recommendations emanating from INAE Seminars/Workshops/Conferences which are sent to the concerned departments for necessary follow up actions; inputs given by the Academy in formulating and influencing Science & Technology policy; role played by the Academy in enhancing industry – academe interaction and undertaking of research studies on important topical national issues through specially constituted study groups.

Another major topic for discussion during the CAETS Council meeting was regarding "Enhancing the Image of Engineering – Engaging Next Generations and the Public". INAE and Chinese Academy of Engineering were requested to lead this topic. Dr. Baldev Raj highlighted that engineers play a vital role in society through development of sustainable infrastructure; creating amenities to improve the quality of life; ensuring efficient use of natural resources; protection of environment and accelerating the economic development of a country by sustainable development; however there is a need to create mechanisms to recognize engineers and their success commensurate to their creativity and contributions to society. A few measures suggested for enhancing the image of engineering and engineers are : (a) active advocacy programmes to publicize the invaluable role played by engineering and engineers in our day-today lives (b) engineering colleges to be linked

with schools to create interest among students to pursue careers in engineering (c) industry and engineering colleges to work together to enhance public image of engineers (d) effective dissemination of successes and (e) awards for engineering achievements and innovations.

INAE's suggestion to prepare a Coffee Table Book to enhance the image of engineering as a CAETS-INAE initiative was welcomed by all. In this connection, Dr. MJ Zarabi mentioned that relevant inputs would be obtained from all CAETS member Academies and the material would be synthesized by INAE for publication of this Coffee Table Book. The Council approved this suggestion.

This was followed by a presentation by Dr. MJ Zarabi, who briefed regarding various events/activities being planned in connection with the INAE Silver Jubilee Celebrations commencing on April 20, 2012. He further mentioned regarding the INAE Conference on "Towards a Better Innovation Ecosystem" scheduled to be held during Sep 20-21, 2012 at New Delhi. He brought out that innovation is indispensable for organizations to remain competitive and is indeed a major driver of the progress of any country. The objective of the conference is to provide a platform for exchange of ideas and for collaborations and engagement between the countries participating in the conference. He invited the CAETS Member Academies to depute speakers to participate in this conference.

CAETS Annual Meeting and Symposium on "Urban Development and Evolution of Public Transportation" will be hosted by Swiss Academy of Engineering Sciences (SATW) during Aug 29-31, 2012 at Zurich, Switzerland.

INAE delegation also had separate discussion meetings with selected member Academies of CAETS to discuss specific topics of mutual interest and collaboration. The salient points discussed are given below.

1. National Academy of Engineering of Korea

MOU signed with NAEK. Specific areas of mutual collaboration to be identified shortly.

2. Australian Academy of Technological Sciences and Engineering (ATSE)

(a) Follow-up action on following specific areas identified consequent to INAE-ATSE Joint workshop on "Energy Efficiency" held on April 11-12, 2011 at New Delhi.

- Performance enhancement of existing power plants
- New technologies for power generation
- Distributed generation management
- Building energy efficiency
- Building energy efficiency upgrade
- Building energy-efficiency technology development

(b) INAE-ATSE joint workshop on "Solar Photovoltaic and Solar Thermal Technologies" to be held during October 2012 in Australia where leading experts from India and Australia will join together and conduct detailed deliberations on the complete spectrum of solar energy with the aim of building a roadmap for faster penetration of these technologies in India and Australia.

3. Chinese Academy of Engineering

(a) Joint activity on digital library

(b) Engineering education with emphasis on growing young leaders in the two countries to meet national and global challenges

(c) Low carbon technologies with emphasis on clean coal.

4. Canadian Academy of Engineering

Joint workshop to be organized on Clean Coal Technology at New Delhi.

5. The Royal Academy of Engineering, UK

A Theme Meeting on “Functional Materials and Structures” to be organized jointly with Royal Academy of Engineering, UK

Collaboration with Foreign Academies

Consequent to the recent signing of MOU between INAE and various member academies of Council of Academies of Engineering and Technological Sciences (CAETS), the following events/activities have been planned during the current year.

Chinese Academy of Engineering

A Workshop on “Digital Library” is being jointly organized by INAE with Chinese Academy of Engineering. Prof. Rajeev Sangal, Director, IIIT Hyderabad and Prof. Zhuang Yueting from Zhejiang University from Chinese Academy of Engineering are the coordinators for the workshop. The workshop will focus on books, manuscripts and digital libraries; digital heritage; language technologies; multimedia digital libraries; data mining, databases and scalability; and HCI, delivery and networking issues. 5-10 experts from China, 10-12 experts from India and 2-3 experts from other parts like USA/Europe will participate in the workshop. In addition, around 150 researchers, faculty and research scholars within the country are expected to attend the workshop.

Canadian Academy of Engineering

India-Canada Joint Conference on Clean Coal Technology is scheduled to be held on Dec 4, 2012 at India International Centre, New Delhi. Dr. KV Raghavan is the Convener of the conference. The major objectives of the conference are to engage in dialogue to mutually learn from the best practices and brainstorm on ideas that can provide game changing pathways on clean coal technologies; to facilitate participation of specialist engineers, policy makers and industry leaders from both countries to interact on identified issues and to bring together a report highlighting the considered views of experts on various issues of common interest with policy, technical and economic implications. The conference is planned to be conducted in four sessions viz. Engineering Presentations on the status of Canada in Clean Coal Technology Development and Application; Engineering Presentations on the status of India in Clean Coal Technology development and application; Identification of Areas of common interest for Joint Initiatives for New Technology Solutions and Conclusion. Some of the topics being covered by the speaker are “Overview of Clean Coal Technology and its Impact on Canada”; “Bioconversion of Coal by Engineering Pathways”; “Circulating Fluidized Bed Boilers for Coal Power Plants”; “Clean Coal Technologies –Indian Status” and “IGCC and its Implementation in India”. The focus will be on the status of R&D and its commercialization in each area, the technology gaps, technology roadmapping, areas which need Indo-Canadian engagement at international level and scope for technology transfer and demonstration. The conference shall be attended by about 50 delegates.

The Royal Academy of Engineering, UK

A Theme Meeting on “Functional Material and Structures” being organized by INAE with Royal Academy of Engineering (RAEng), UK during Nov 2012 at University of Hyderabad. Professor S. R. P. Silva from RAEng, UK and Prof. K. Bhanu Sankara Rao from INAE are coordinators for this event. The conference topic “Engineering a more Sustainable World for Tomorrow” will broadly cover materials for energy generation, capture and transmission, sustainable manufacturing, renewable energy policy and governance, wealth creation for the nation via engineering and nano-engineering for emerging technologies.

Australian Academy of Technological Sciences and Engineering (ATSE)

- (a) INAE-ATSE joint workshop on “Solar Photovoltaic and Solar Thermal Technologies” – INAE-ATSE joint workshop on “Solar Photovoltaic and Solar Thermal Technologies” will be held during October 15-19, 2012 at Canberra, Australia. Dr. RR Sonde, FNAE, Executive Vice-President, Thermax, Pune is the Convenor from INAE side and Dr. Mike Sargent is the Convenor from ATSE. The speakers identified from India are Dr. RR Sonde, Mr. Shyam Chetty, Director National Aerospace Laboratories, Bangalore; Dr. Satish Ogale, Scientist G, CSIR; Prof. SP Vishwanathan, President KG Designs; Prof. Vivek Agarwal, FNAE, Professor IIT Bombay; Dr. Ajay Dhar, Senior Scientist, NPL and Dr. Dilip Saha. The objective of the workshop is to bring together leaders in solar thermal and photovoltaic technologies from Australia and India, to discuss research, development and large-scale deployment of the technologies and related policies needed in each country. This will open opportunities for further collaboration, and drive the development of important international S&T networks. Technical visits to Liddell Power Station; Australia Solar Institute, Newcastle, University of Newcastle and University of New South Wales ARC Photovoltaics Centre of Excellence will be organized. The workshop, round table meeting and associated technical visits would look to influence policy development to facilitate and encourage the advancement of the development and application of solar thermal and photovoltaic technologies in both Australia and India; establish collaborative research projects to progress the research, development and demonstration of solar energy technologies and encourage researcher exchanges.
- (b) CAETS Project on “Deployment of Low Emissions Technologies for Electric Power Generation in Response to Climate Change” – A Report on “Deployment of Low Emissions Technologies for Electric Power Generation in Response to Climate Change” was prepared during November 2010 by a Working Group comprising selected member academies of CAETS - Indian National Academy of Engineering, acatech, Canadian Academy of Engineering, Engineering Academy of Japan, South African Academy of Engineering and The Royal Academy of Engineering, UK.

This Working Group was tasked to undertake the second phase of the study on “The Challenges facing Low-Carbon Energy Technologies for Power Generation to 2050”. A draft report prepared by this Working Group was discussed during a meeting held on June 27, 2011 at Mexico on the sidelines of CAETS Convocation, in which representatives from Australia, Canada, Germany, India, Korea, UK and South Africa participated. INAE was tasked to give relevant inputs on the topics of Solar Energy (various forms including solar thermal energy) and “Risks to Deploy Low Carbon Energy (LCE) Technologies to Scale”. Based on the material received from the members of INAE Energy Forum, a report prepared by INAE has been sent to ATSE. The section on risks to deploy LCE technologies to scale focused on the risks involved in deployment of green technologies with optimized minimal use of energy and natural resources; cost effectiveness and reduced environment footprint. The technological and financial risks involved in tapping of the most promising renewable energy sources such as solar, wind, bio and small hydro were also touched upon. The section on Technology Assessment of Solar Energy covered the topics on current state of the technology; most promising initiatives that might accelerate investment and deployment of solar power technologies; integration and combination with other technologies that can accelerate investment and deployment of solar technologies; technological/engineering risks to be overcome to achieve wide-scale solar energy deployment incorporating the most promising initiatives; investments required at scale for solar technologies incorporating the most promising initiatives and timescale for deployment of potential solar power options through the most promising initiatives. An international perspective of solar energy was also presented. The finalized report pertaining to INAE has been forwarded to ATSE.

Promoting Excellence in the Field of Engineering

Life Time Contribution Award in Engineering 2011

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.

Dr. VS Arunachalam, Chairman, Centre for Study of Science, Technology and Policy (CSTEP), Bangalore; and Mr. SS Chakraborty, Managing Director, Consulting Engineering Services (India) Ltd., New Delhi were conferred the Life Time Contribution Awards in Engineering 2011.

Prof. Jai Krishna and Prof. SN Mitra Memorial Award 2011

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) and 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 Engineering and Special Fields).

Dr. Dipankar Banerjee, Professor, Department of Materials Engineering, Indian Institute of Science, Bangalore and Dr. RK Sinha, Director, Bhabha Atomic Research, Mumbai were conferred Prof. Jai Krishna Memorial and Prof. SN Mitra Memorial Awards for 2011 respectively.

INAE Young Engineer Awardees 2011

The Academy in 1996 instituted INAE Young Engineer Awards for 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, 147 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 this award for the year 2011 were sought from INAE Fellowship, Engineering institutions, R&D Labs during February 2011. Out of 113 candidates (including 42 carried over from the previous years), 35 were shortlisted by the Sectional Committees in their meetings held on August 12, 2011 at New Delhi. The shortlisted candidates gave presentation of their work before the Selection Committee on August 25, 2011 at New Delhi.



The following ten candidates have been selected for conferment of Young Engineer Award 2011 :

- 1 Dr. Subimal Ghosh, Assistant Professor, Department of Civil Engineering, Indian Institute of Technology Bombay, Mumbai
- 2 Dr. Vijay Natarajan, Assistant Professor, Department of Computer Science and Automation, Indian Institute of Science, Bangalore
- 3 Dr. Abir Chakraborty, Senior Researcher, India Science Lab, General Motors Technical Centre India Pvt. Ltd., Bangalore
- 4 Dr. A. Arockiarajan, Assistant Professor, Department of Applied Mechanics, Indian Institute of Technology Madras, Chennai
- 5 Dr. Niket S Kaisare, Assistant Professor, Department of Chemical Engineering, Indian Institute of Technology Madras, Chennai
- 6 Dr. Andrew Thangaraj, Associate Professor, Department of Electrical Engineering, Indian Institute of Technology Madras, Chennai
- 7 Dr. Chirashree Roy Chaudhuri, Assistant Professor, Department of Electronics and Telecommunication Engineering, Bengal Engineering and Science University Shibpur, Howrah
- 8 Dr. Sudarshan Kumar, Associate Professor, Department of Aerospace Engineering, Indian Institute of Technology Bombay, Mumbai.
- 9 Dr. KV Rajulapati, Assistant Professor, School of Engineering Sciences and Technology, University of Hyderabad, Hyderabad
- 10 Dr. B Madhan, Scientist 'C', Central Leather Research Institute, Chennai

Innovative Student Projects Awardees 2011

The Academy has instituted 'Innovative Student Projects Award' since 1998 to identify innovative and creative research projects undertaken by the students at three levels, B.E./B.Tech, M.E./M.Tech and Ph.D in engineering colleges.

99 nominations received, at Doctoral level (14); Master's level (25) and Bachelor level (60) were examined by the Selection Committee on August 11, 2011. Out of these, 42 nominations (Doctoral level (10); Master's level (12) and Bachelor level (20) were shortlisted.

The shortlisted candidates gave presentations of their work before the Selection Committee on August 26, 2011 at New Delhi.

The following twenty theses/projects (Doctoral level (6); Master's level (5) and Bachelor level (9) have been selected for conferment of Innovative Student Projects Award 2011 :

Ph.D. Level

- 1 Dr. Shruti Sharma, Thapar University, Patiala (*Monitoring of Damage in Reinforcement in Concrete*)
- 2 Dr. Pritha Banerjee, Indian Statistical Institute, Kolkata (*Fast Placement and Floorplanning Methods in Modern Reconfigurable FPGAs*)
- 3 Dr. Pralay Mitra, Indian Institute of Science, Bangalore (*Algorithmic Approaches for Protein-protein Docking and Quaternary Structure Inference*)

- 4 Dr. Chandra Shekhar Sharma, Indian Institute of Technology, Kanpur (*Synthesis, Fabrication and Properties of Carbon based Multiscale Micro and Nano Structures*)

- 5 Dr. Subba Reddy B, Indian Institute of Science, Bangalore (*A Novel Technique for Enhancing the Pollution Flashover Strength of Ceramic Disc Insulators*)

- 6 Dr. Kaushik Bhattacharyya, Indian Institute of Technology, Kharagpur (*Design and Implementation of Switched Capacitor based embedded DC-DC Buck Converter*)



M.E./M.Tech Level

- 1 Mr. Sambit Bakshi, National Institute of Technology, Rourkela (*Development of Robust Iris Localization and Impairment Pruning Schemes*)
- 2 Ms. Priyanka N, Sri Venkateswara College of Engineering, Sriperumbudur (*A Boost Converter with an Active Clamp Circuit for High Intensity Discharge Lamp Application*)
- 3 Mr. Adithya Kumar Pediredla, Indian Institute of Science, Bangalore (*Robust Cell Detection and Active Contour Models for Cell Segmentation*)
- 4 Mr. Vikas Singh, Indian Institute of Technology, Madras, Chennai (*Design of High Speed, High Resolution Continuous-Time Delta Sigma Modulator*)
- 5 Mr. Gopinath T, Bengal Engineering and Science University, Shibpur (*Structure and Properties of Diffusion bonded joints between Stainless Steel and Titanium Alloy with Interlayer*)

B.E./B.Tech Level

- 1 Mr. Ankit Chhabra, Visvesvaraya National Institute of Technology, Nagpur (*Modal Mass Criteria for Optimum Tuned Mass Dampers*)
- 2 Mr. Ayan Dutta and Mr. Suparno Datta, Heritage Institute of Technology, Kolkata (*Distributed Algorithm for Circle Formation by Anonymous Transparent Fat Robots*)
- 3 Ms. Sujatha Krishnaswamy, Sri Venkateswara College of Engineering, Sriperumbudur (TN) (*A Certificateless designated verifier ring signcryption scheme-Design and Implementation*)
- 4 Ms. F. Menaka Mischella and Ms. Lasante Christina, St. Joseph's College of Engineering, Chennai (*Navigation Database Decoder*)
- 5 Mr. Saravanan S, St. Joseph's College of Engineering, Chennai (*Design and Development of a Multi-purpose Air-conditioner*)
- 6 Mr. U Mahendaran and Mr. M Prasanth, PSG College of Technology, Coimbatore (*Design and Development of Smart Wing Using SMA*)
- 7 Ms. Saranya M, Mr. Swaminathan S and Mr. Vijay Karthick B, Sri Venkateswara College of Engineering, Sriperumbudur (TN) (*SMART-The Automated Food Concocter*)
- 8 Mr. J Srinivasan, Muthayammal Engineering College, Namakkal (TN) (*Real-Time Remote Crack Detection System for Railway Track using Time Domain Reflectometer [TDR]*)
- 9 Mr. Nelson Naveen I and Ms. Princy Perpetua C, St. Joseph's College of Engineering, Chennai (*Real Time Implementation of GPS based Maritime border indicator for Fishermen*)

Research Schemes

With the objective to encourage invention, investigation, research and promote high caliber of engineering-scientists, INAE has instituted four schemes, viz., INAE Chair Professorship; INAE Distinguished Professors/Technologists; Mentoring of Engineering Teachers by INAE Fellows and Mentoring of Engineering Students by INAE Fellows.

In connection with the above mentioned schemes, the following nominations were approved by the Council.

INAE Chair Professorship

Prof. C. Siva Ram Murthy, Department of Computer Science & Engineering, Indian Institute of Technology, Madras, Chennai.

Prof. Pradip Dutta, Department of Mechanical Engineering, Indian Institute of Science, Bangalore

INAE Distinguished Professors/Technologists

Prof. Himadri Sekhar Maiti, Visiting Professor, Department of Ceramic Engineering, National Institute of Technology, Rourkela

Mentoring of Engineering Teachers by INAE Fellows

S No	Name of Engineering Teacher	Institution of Teacher	Name of Mentor
1	Dr. Prakash Biswas	Indian Institute of Technology, Roorkee	Dr. MO Garg
2	Mr. Hridesh Kumar Verma	Galgotia College of Engg. & Technology, Greater Noida	Prof. SK Koul
3	Mr. G. Konda Reddy	Sreenidhi Institute of Science & Technology, Hyderabad	Prof. G Venkateswara Rao
4	Dr. Dipankar Narayan Basu	Bengal Engineering & Science University, Shibpur	Prof. Souvik Bhattacharya
5	Mr. M Sreedhar	NM Institute of Engineering & Technology, Bhubaneswar	Prof. Janardan Nanda
6	Dr. Shantanu K Behera	National Institute of Technology, Rourkela	Prof. Vikram Jayaram
7	Mrs. Mousami Vaibhav Munot	Pune Institute of Computer Technology, Pune	Dr. Jayanta Mukhopadhyay
8	Mr. Upendra Kumar Sahoo	National Institute of Technology, Rourkela	Prof. Ganapati Panda

S No	Name of Engineering Teacher	Institution of Teacher	Name of Mentor
9	Mr. Harish Kumar Sahoo	International Institute of Information Technology, Bhubaneswar	Prof. Sivaji Chakravorti
10	Ms. Joymala Moirangthem	SRM University, (TN)	Prof. PK Dash
11	Mr. Milan Kumar Biswal	Sillicon Institute of Technology, Bhubaneswar	Prof. PK Dash
12	Mr. Tarakeshwar TR	Siddaganga Institute of Technology, Tumkur	Prof. KN Seetharamu
13	Mr. Vikram CK	PES College of Engineering, Mandya	Prof. KN Seetharamu
14	Mr. P. Rajakumar	Sri Sairam Engineering College, Chennai	Dr. Sukumar Mishra
15	Prof. Birendra Biswal	GMR Institute of Technology, AP	Dr. Sukumar Mishra
16	Ms. Ranjeeta Bisoi	Siksha O Anusandhan University, Bhubaneswar	Dr. Sukumar Mishra
17	Dr. GVS Nageswara Rao	National Institute of Technology, Warangal	Dr. T Jayakumar

Mentoring of Engineering Students by INAE Fellows

S No	Name of Engineering Teacher	Institution of Teacher	Name of Mentor
1	Mr. K. Ashoke Raman	National Institute of Technology, Durgapur	Prof. Gautam Biswas
2	Mr. Aniket Kumar	National Institute of Technology, Jamshedpur	Prof. SK Koul
3	Ms. Sayanti Bandyopadhyay	University Institute of Technology, University of Burdwan	Prof. Bhabatosh Chanda
4	Mr. Ratan B Ahuja	Vishwakarma Institute of Technology, Pune	Dr. SK Basu
5	Ms. Jananee S	Shri Bhagwan Mahaveer Jain College of Engineering, Ramanagara District.	Prof. S Kalyanaraman
6	Mr. Rajnish Chandra Bhaskar	National Institute of Technology, Jamshedpur	Prof. Vinod Kumar Agrawal
7	Mr. Shubham Dattaram Pingre	National Institute of Technology Surathkal, Karnataka	Dr. Ashish Lele
8	Mr. Alok Kumar Srivastava	National Institute of Technology, Jamshedpur	Dr. SK Sarangi
9	Mr. Saurav Roy Choudhury	National Institute of Technology, Raipur	Mr. Manjit Singh

S No	Name of Engineering Teacher	Institution of Teacher	Name of Mentor
10	Mr. Ankit Jain	National Institute of Technology, Hamirpur (HP)	Prof. UB Desai
11	Ms. Akriti Agrawal	Birla Institute of Technology and Sciences, Pilani	Prof. SN Upadhyay
12	Ms. Jaya Choudhury	National Institute of Technology, Jaipur	Prof. Sivaji Chakravorti
13	Mr. I Adithyan	Indian Institute of Technology, Hyderabad	Prof. B Sundar Rajan
14	Ms. Shikha Jodhani	Maulana Azad National Institute of Technology, Bhopal	Prof. Vinay Kumar Gupta
15	Ms. Adyasha Panda	National Institute of Technology, Rourkela	Prof. Ganapati Panda
16	Mr. Amar Ujjwal	National Institute of Technology, Jamshedpur	Dr. SK Ray
17	Ms. Nileena K	Co-Operative Institute of Technology Vatakara, Kerala	Dr. AS Chawla
18	Mr. Joshi Kumar AV	Sri Sairam Engineering College, Chennai	Prof. Subhasis Chaudhuri
19	Mr. Karun Mathew Joseph	National Institute of Technology Surathkal, Karnataka	Dr. Nagesh R Iyer
20	Mr. Rahul	National Institute of Technology, Jamshedpur	Dr. Nagesh R Iyer
21	Mr. Anupaju Manikanta	Mahatma Gandhi institute of Technology, Hyderabad	Prof. K Bhanu Sankara Rao
22	Mr. N.E.P. Shubhakar	Mahatma Gandhi Institute of Technology, Hyderabad	Prof. K Bhanu Sankara Rao
23	Mr. Jyotiranjana Das	Veer Surendra Sai University of Technology, Burla (Orissa)	Dr. DN Singh
24	Mr. Kshitij Prabhu	Maulana Azad National Institute of Technology, Bhopal	Dr. DN Singh
25	Mr. Rakesh S	Tagore Engineering College	Prof. Rajaram Nagappa
26	Mr. G Sairam	Tagore Engineering College	Prof. Rajaram Nagappa
27	Mr. Ankit Agrawal	National Institute of Technology, Jamshedpur	Prof. J Nanda
28	Mr. Abhishek Porwal	Malaviya National Institute of Technology, Jaipur	Prof. J Nanda
29	Ms. J Anuja	Visvesvaraya National Institute of Technology, Nagpur	Prof. BS Murty

S No	Name of Engineering Teacher	Institution of Teacher	Name of Mentor
30	Mr. LVR Ravi Teja	National Institute of Technology, Warangal	Prof. BS Murty
31	Mr. Agnish Kumar Dhiman	Indian Institute of Technology, Kanpur	Prof. KT Jacob
32	Ms. Juhi Sharma	Malaviya National Institute of Technology, Jaipur	Prof. KT Jacob
33	Ms. Amrita Sengupta	National Institute of Technology, Durgapur	Prof. Pradip Dutta
34	Ms. Nandini Debnath	National Institute of Technology, Durgapur	Prof. Pradip Dutta
35	Mr. Bevin Mathew	National Institute of Technology Surathkal, Karnataka	Prof. K Ramesh
36	Mr. Nanda Gopal	National Institute of Technology Surathkal, Karnataka	Prof. K Ramesh
37	Mr. Ravi Kant Singh	National Institute of Technology, Jamshedpur	Dr. Subrata Chakraborty
38	Mr. Kumar Varun	National Institute of Technology, Jamshedpur	Dr. Subrata Chakraborty
39	Mr. S Venkata Abhishek	Andhra University College of Engineering (Anna University)	Prof. MR Madhav
40	Mr. G Naveen Kumar	Jawaharlal Nehru Technological University College of Engineering, Hyderabad	Prof. MR Madhav

Research Studies

Studies on issues of national interest are undertaken by the Academy through specially constituted study groups. The objective is to bring out a comprehensive/exhaustive document covering review of national and international technological and commercial aspects, analysis of options, future trends and policy/recommendations for the future roadmap.

Research studies on “Technologies for Healthcare Sector in India”; “Impact of R&D on Chemical Industry”; “Assessment of Civil Engineering Inputs for Infrastructural Development”; Research studies on “Impact of R&D on Indian Mineral Industry Performance – Identifying New Priorities and Strategic Initiatives”; and “Water Resources Management” have been printed.

Technologies for Healthcare Sector in India

With global revenues of an estimated \$2.8 trillion, the healthcare industry is the world’s largest industry. India’s high population makes it an important player in this industry. While healthcare sector could broadly be categorized into (i) Medical diagnostics and (ii) Therapeutics, it encompasses testing, treatment, care, procedures and any other service or intervention, nursing, rehabilitative, palliative, convalescent, preventative, and/or other health related purpose or combinations thereof, including reproductive health care and emergency medical treatment, in any system of medicine. Technology for healthcare includes machinery/equipment/devices or methods for diagnostics as well as for therapeutics that may be used in relation to provision of healthcare services.

The healthcare sector in India is witnessing a surge of activity and the beginning of what is seen as a rapid phase of growth. Emerging healthcare segments like diagnostic chains, medical device manufactures as well as hospital chains are increasingly attracting investments from a variety of venture capitalists. Engineering will play a major role towards a better and deeper understanding of the technical challenges that surround the healthcare sector in India. Engineers can develop, adapt, and help implement the technological enablers of continuous innovations in health care.

Keeping in view the importance of above, a research study group on “Technologies for Healthcare Sector in India” was constituted comprising of Dr. Rajeev Shorey as Coordinator and Dr. MJ Zarabi as Member. This study relates more to the status of the healthcare sector with an emphasis on India and deals primarily with the diagnostic side of the healthcare. The objective of this report is to gain a deeper understanding of the healthcare sector with a major focus on India. The report investigates in detail both existing and emerging technologies in the healthcare sector. More specifically, the broad topics covered in the report include key factors leading to the growth of healthcare sector in India, India’s healthcare system, technologies for the healthcare sector, technical challenges that lie ahead and global medical and equipment market.

Efforts were made in obtaining information that is already available – from technologies, applications, standards to compilation of key players and their role in the healthcare sector. A day-long “Discussion Session” was held on April 3, 2010 at India International Centre, New Delhi to solicit inputs, views, comments and recommendations of concerned experts/professionals from medical fraternity, industry, academia and R&D on the subject and based on the discussions, core recommendations were prepared.

The experts have pointed out several gaps and challenges in the health care sector in India. India needs high quality medical grade equipment in all categories including hospital beds, switches, plug points etc. and these are not indigenously manufactured. The challenge for Indian policy-makers is to find ways to improve upon the existing situation in the health sector and to make equitable, affordable and quality health care accessible to the population, especially the poor and the vulnerable sections of the society. There is an urgent need to document global and Indian experiences in social health insurance. Different financing options would need to be developed for different target groups. The wide differentials in the demographic, epidemiological status and the delivery capacity of health systems are a serious constraint to a nationally mandated health insurance system. Given the heterogeneity of different regions in India and the regional specifications, one would need to undertake pilot projects to gather more information about the population to be targeted under an insurance scheme and then develop options for different population groups.

The challenge for Indian policy-makers is to find ways to improve upon the existing situation in the health sector and to make equitable, affordable and quality health care accessible to the population, especially the poor and the vulnerable sections of the society. The Government should take effective steps to ensure increase in the affordability to the health insurance schemes, especially amongst the rural population. With higher insurance penetration in the country, the accessibility to quality healthcare services would greatly improve. Government should provide advantages to the private sector in terms of long term tax benefits for establishing hospitals in the rural areas.

India needs to create a conducive environment and the following recommendations have been made.

(a) Attracting investment

- Granting infrastructure status to the healthcare sector
- Creating fiscal policies, such as providing low interest rate loans, introducing tax holidays for investment in low per capita income states, reducing import/excise duty for medical equipment, et cetera, to promote investment in healthcare services
- Facilitating various clearances and certifications such as medical registration number, etc.

(b) Changing the legislation

- Mandating the employers to buy group or individual medical insurance for their employees to ensure a certain minimum financial coverage
- Mandating the private sector units that take advantage of improved fiscal policies, to commit resources to remote rural/under developed sectors
- Create an autonomous body to standardize on medical messaging, codes and vocabulary, content and format, identification standards and security
- Mandate the healthcare service providers to transmit select patient data to the government for analysis. This data will be analyzed to identify trends and evolve policies
- Create a national database of health care providers, their facilities and services. This will create awareness among the population towards quality health care
- Streamline the process of handling patient grievances
- Create a nationwide agency to deal with patient requests such as ambulance hotline, emergency/first-aid consultation, trauma help-line, etc.

(c) IT initiatives

- Sharing of patient information between providers, patient and payers
- Security and privacy services
- Need for standards for messaging, codes and vocabulary, content and format standards

Summarized below are the areas of high priority in the healthcare sector that need immediate attention in India

- (a) There is a need for scalable, cost-effective pervasive technologies for healthcare. With the convergence of Telecom and Healthcare sectors, health is becoming an extremely important paradigm in India today.
- (b) There is a dire need for cost-effective equipment and instruments for screening and diagnosis at the 'Point of Care'.
- (c) The country needs to leverage ICT technologies to improve the state of healthcare in rural and semi-rural areas. The Government needs to provide major incentives for specialists and doctors so that they consider spending time in rural areas in the country.
- (d) The country needs to invest in medical education with an emphasis on healthcare and related sectors. There is a need to invest in training centers and polytechnics in healthcare sector so as to attempt to fill the huge demand-supply gap of specialists.
- (e) We need to invest huge amount of effort and money and ensure that citizens who cannot afford complex treatment and medicines, are provided health insurance by the state.
- (f) Venture capitalists and Angel investors in India need to support incubation centres and start-ups in the healthcare sector.

The report should be considered as an in-depth survey of the healthcare sector in India with an emphasis on 'technologies' and how technologies can help in improving the healthcare sector. The report will indeed serve as an actionable document for thought leaders in the Government, industry and academia, in India and abroad, and will spawn a lot more research, innovation and incubation in the healthcare sector in the years to come.

Impact of R&D on Indian Chemical Industry

A study group comprising of Dr. KV Raghavan as Coordinator and Dr. DP Misra, Dr. MO Garg and Dr. AN Maitra as Members was constituted to undertake the research study on "Impact of R&D on Indian Chemical Industry". The basic objective of the study is to study the impact made by the R&D on Indian Chemical Industry as a whole and on all its important subsectors in terms of R&D intensity, intellectual property management, industry-university (I-U) linkages, fostering new enterprises, government funded R&D utilization and human resource management. The project team collected enormous data from the open literature as well as through opinion surveys and direct interaction with subject experts to develop the current profile of the Indian chemical industry. This exercise has shown that the turnover of Indian chemical industry has crossed USD 60 billion, achieved an export/import ratio of greater than unity and the pharma, biotech and petrochemical sectors have attracted significant FDI inflows as compared to other subsectors.

The overall R&D Intensity (R&DI) of Indian chemical industry is estimated to be 0.9% with knowledge intensive chemical sector registering 4.5%, specialty chemical sector recording a moderate growth at 1% level and the basic chemical sector touching 0.5% in 2007-08. A sample analysis conducted on 250 leading companies in various subsectors has brought out the mismatch between their turnover growth and R&D expenditure. While the sectors like pharma and organics have shown the sensitivity of R&D Intensity to the firm size, this behaviour is somewhat muted in all other sectors. Interestingly, the subsectors of Indian chemical industry have exhibited different threshold limits for incurring R&D expenditure with the drugs/pharma and fertilizer sectors on the higher and lower ends of the scale respectively.

During 1992-09, the chemical export growth remained steady at a CAGR of 17% and its FDI growth recorded a CAGR of 13.9% with somewhat unstable growth profile. The forward and backward FDI-economy linkages in Indian chemical sector are quite strong. During 1998-03, 24 chemical oriented R&D centres were established by MNCs in India with a planned investment of USD 1.7 billion.

A copy of the Report formally handed over to Dr. R Chidambaram, PSA to the Govt. of India during a meeting held in his office on May 24, 2011



The intellectual property generation and protection profiles of Indian Chemical sector during the transition and post WTO periods, provide strong evidence of internationalization of research in terms of constantly dropping Indian inventor contribution to the patents filed at IPO, upward trend in overseas collaborations in Indian research publications and Indian inventors filing significant number of patents in overseas patent offices. The PCT route has emerged as the most favourite pathway for the overseas inventors at IPO. While research papers in chemical and allied sciences are being published by more than 250 Indian institutions, the top performers with a consistent record are limited in number in most S&T sectors. A silver lining is the significant increase in the quality of research papers published during 1995-09 by the top 10 performing Indian institutes. While public funded research institutions have done relatively well in publishing research papers, the contribution from universities and industry is somewhat disappointing. An area of concern has been the suboptimal performance of Indian universities in intellectual property protection possibly due to their weak industry linkage and lack of incentives for faculty to pursue industrial research. The studies have also shown the initial successes achieved in product patenting in India after 2005 with overseas pharmaceutical companies filing the maximum product patents.

As far as industry-university (I-U) linkages in chemical sector are concerned; the suboptimal performance of Indian universities, with few exceptions, in generating industrially relevant knowledge is evident. Even though 2500+ projects have been funded by the government in Indian academic institutions with more than Rs.100 corers funding during 2000-10, they have very little industrial relevance except in the case of IIT's in which certain degree of success has been achieved in making some of their projects industry driven.

The INAE team studied the R&D scenario of micro, small and medium scale enterprises (MSME's) in Indian chemical sector. Their number in organized sector is more than 40,000 with nearly 20% of them exist in 80 chemical clusters spread over 20 Indian states. In spite of the central and state government facilitation to Chemical MSMEs, their R&DI is extremely low on account of insufficient R&D inputs. This is a matter of great concern considering their overall importance to the growth of Indian chemical sector. Bold initiatives are needed in this area.

The INAE team noted the strength of the knowledge intensive segment of Indian chemical industry in promoting new technology ventures during the post economic liberalization period. It has, however, shown the need to establish more such ventures in specialty and basic chemical sectors propelled by a strong I-U linkage.

The INAE studies have clearly established that R&D impact on Indian chemical industry is non-uniform across its subsectors on account of system heterogeneities, varied scales of operation, uneven responses to globalization challenges and wide variation in human skills and innovative capabilities. In order to enhance R&D impact on the Indian chemical industry, following recommendations have been made in this report:

- Enhancing the reach and effectiveness of government funded R&D programmes in seamless manner
- Integrated approach for R&D capacity building in chemical MSME clusters
- Enhancing R&D intensity and investment in 3 prioritized turnover zones
- A technology mission to formulate and pilot test novel I-U linkage models
- Establishing technology innovation centres through PPP in frontier S&T areas
- A two pronged approach to enhance Indian inventorship of patents filed in India
- Improving environmental brand image to sustain future growth
- Technology vision and foresight development for critical chemical subsectors
- New growth oriented HR management policies for chemical subsectors
- Innovative policies to make transnational R&D and FDI as vehicles for Indian innovation.

Apart from the above recommendations, several implementable actions and special studies have been included in each chapter of this report.

Assessment of Civil Engineering Inputs for Infrastructural Development

The research study on “Assessment of Civil Engineering Inputs for Infrastructure Development” was undertaken by the research study group comprising Prof SS Chakraborty as Coordinator and Prof. Prem Krishna, Dr. Nagesh R Iyer and Dr. SK Thakkar as Members. The aim of the study is to develop a position paper on civil engineering manpower available in the country at present and envisions the needs for the ensuing immediate future. It covers emerging trends in civil engineering technology, the expected growth of various forms of infrastructure and developments in other disciplines of engineering where civil engineering plays an important supporting role. Further, the issues of quality as well as the measures for bridging the gap were addressed. The study also sought to draw a realistic road map that quickens inclusive development of the society as well as the profession. The focus is on the availability of well-equipped manpower in a sustained manner, facilitated by projected inputs from the industry and a supportive framework of Government policies and programmes. The study estimated the civil engineering manpower requirement for meeting the infrastructural development targets.

The research study focused on the broad dimensions of the issue, namely the requirement of civil engineers and their availability, and estimating the gap between the two. Further, the issues of quality as well as the measures for bridging the gap are addressed. The Report begins with the requirements for the study and delineates the methodology adopted. It takes the performance of the Eleventh Five Year Plan (XI FYP) as a proxy and its sectoral allocations as the template for the XII FYP with an investment target of Rs. 46,12,500 crores in the infrastructure sector. The report seeks to give a broad overview of the two important aspects, namely, the requirement and the adequacy of the civil engineering workforce. The focus is on evaluating the requirement of civil engineers, particularly engineering graduates, to meet the infrastructure needs in various relevant sectors. The subsequent discussion focuses on the availability of well-equipped manpower, from the academia and the research institutions in a sustained manner, facilitated by projected inputs from the industry and a supportive framework of Government policies and programs.

The disaggregated man power requirement sector-wise is as follows:

Briefly, in the roads and highways sector, indicative calculations show that an average annual enhancement in the order of 38,000 is necessary to absorb the XII Five Year Plan (FYP) outlay. For railways, the Indian Railways being keen on upgrading technology, it is only appropriate that

civil engineers, with their expertise in GIS and other relevant advanced technologies, will comprise a higher share, say 0.4% in the personnel requirements, implying an addition of 27,000 during XII FYP. In the power sector, the annual enhancement, estimated at 26,200 has another important hidden feature: the changes in the skill set of the workforce given that the energy mix would be different with renewable and nuclear power purported to occupy a larger space. Rapid urbanization demands an annual average increment of 35,000 civil engineers to the workforce. Similar estimates with regard to civil engineering components of the various other sectors lead to an average annual enhancement of the order of 160,000, from the current level of about 15,000.

India is poised to reap huge demographic dividends over the next two decades which have to be availed of with a sense of urgency. In this scenario, any programme to improve civil engineering education has to be pragmatic and affordable. While rapid urbanization makes education more accessible, it also requires huge improvements in the quality of technical education. A robust financial framework has to be devised to meet the requirements while accommodating the constraints. The civil engineering community must focus on how to prepare the current workforce better to appreciate and apply the emerging technologies, and develop appropriate curricula that internalizes dynamism for that purpose in the face of various constraints including, inter alia, availability of funds. The Report explores suitable methodologies in this regard as well as the financial resources needed.

The civil engineering community must focus on how to prepare the current workforce to develop appropriate dynamic curricula. It is estimated broadly that Rs.10,000 crores would be required for creating the necessary infrastructure for producing an additional 1,45,000 graduate civil engineers per annum, whereas the recurring cost might be recovered on a sustainable basis from the students as normal tuition fees. There is a need to find about 40,000 faculty members, across the various sub-disciplines of civil engineering. As regards in-service training, it is suggested that a small percentage of the project cost, to be absorbed in three years, be added to the cost of the project, as a line item in the project budget. It is estimated that an average of nearly 40,000 engineers over the next 6 years could be given appropriate, project-specific training funded from this cess.

The Action Plan outlined is as follows

- (a) Establishing an adequate number of engineering education institutions.
- (b) Civil Engineering degree courses should be mandated for engineering colleges that seek approval.
 - The focus may be shifted away from the IIT model and towards the Tier 2 and Tier 3 levels, with a view to broaden the base for producing good quality graduates.
 - Science graduates (particularly B.Sc with Physics), may be brought into the engineering stream through specially prepared curricula in existing civil engineering programmes.
 - Requirement of Ph.D. Degree for faculty positions may be relaxed for undergraduate teaching, particularly as a short-term measure, in order to annul the acute shortage of faculty. A programme of mentoring the teachers should be taken up as a formal requirement as an immediate measure.
 - The academia should work towards shaping a graduate engineer for professional practice. A student must undergo mandatory professional summer training in industry for a duration of four months before the degree would be conferred on him.
 - A programme of incentives to enter the engineering profession for rural population and girl students - The nodal agency for the above recommendations may be the Ministry of Human Resource Development, Ministry of Rural Development, GoI, and state level authorities with appropriate responsibilities.

- (c) A formal set-up for upgradation of Civil Engineering Education and Practice be framed.
- Specialized training institutions, called Institutions of Civil Engineering Training (ICET), such as National Institute for Training of Highway Engineers (NITHE) should be established, preferably 4 in number, to serve the 4 regions of the country with faculties, primarily from the industry.
 - Institutes that have local relevance like the National Inland Navigation Institute (NINI) at Patna will also have to be replicated across the country. The National Power Development Institute has been put on a strong footing through a combination of government and private party participation.
- (d) The funds for enhancing the civil engineering education scenario and also for in-service training facilities must come from the project costs to the extent it can bear without endangering the viability of the project, particularly in the case of the PPP mode of execution. An indicative suggestion: a line item at 1% of the project cost for the year 2011-12 and at 0.5% thereafter.
- (e) It is suggested that a civil engineering professional entity may be established under the combined auspices of the Industry and the academia for managing such a fund. The fund will feed the ICETs. These will primarily cover the function of mentoring of faculty and of in-service training of graduates, apart from keeping track of the dynamics of the changing needs of the profession and the related curricular changes by:
- Input for academic programmes – curriculum upgrade, faculty training
 - Industry-academia interaction
 - Planning, design and monitoring the implementation of training programmes.
 - Arranging knowledge dissemination events on specific topics
 - Promoting comprehensive development of the civil engineering profession – new technologies, new materials, new design developments etc.

Another important task that ICETs should undertake is to popularize civil engineering. What is proposed here is an outreach programme by the profession for the high schools in the urban as well as the rural areas.

Impact of R&D on Indian Mineral Industry Performance – Identifying New Priorities and Strategic Initiatives

The INAE research study on “Impact of R&D on Indian Mineral Industry Performance - Identifying New Priorities and Strategic Initiatives”, supported by the Office of the Principal Scientific Advisor to the Government of India, sought to assess the impact of R&D on the performance of Indian minerals sector and to evolve a concrete R&D strategy based on this appraisal. The study was undertaken by a 3-member team comprising Prof. AK. Ghose as Coordinator and Prof. RN Gupta and Prof. J. Bhattacharya as members. The study in effect centered on developing a R&D vision for Indian mineral industry which could help strengthen the scientific and technological base of the industry and encourage its competitiveness, based on excellence through innovation.

The minerals sector, despite a hoary and glorious past, contributes to only about 2.5% of the GDP and continues to be identified as a technological laggard. The study called therefore for an in-depth and critical analysis of the R&D initiatives using appropriate metrics for performance evaluation which has highlighted the lacuna in the current industry R&D portfolio, where consultancy is often wrongly construed as R&D and the projects are largely fragmented and small in size to be useful and able to impact on industry's performance in a significant way. Likewise, there are major gaps in research projects in the areas of green mining and purposeful ICT applications. The mining industry also suffers from a serious skill deficit with acute shortage of R&D manpower. A 2-stage

Delphi exercise was undertaken to identify the desired R&D priorities for the industry which were refined and honed in a brain-steering workshop with identified experts from the industry.

Based on this study, the INAE team concluded that for focused effort and maximizing R&D outcomes, there was an imperative need to assemble a critical mass of resources and integrate the research efforts by pulling them together in networks of excellence in "mega" projects which could effectively address the major challenges faced by the industry in improving performance and operational effectiveness, the plethora of environmental concerns and ensuring workforce safety.

The roadmap unveiled primarily addressed the following objectives

- Launching mineral industry technological initiatives by integrating the efforts of different stakeholders on a common research agenda on a PPP model
- Creating Centres of Excellence for effective collaboration between research centres, universities and industry
- Developing world-class research infrastructure by liberally funding the premier national research institutes with effective coordination in national research programmes
- Funding selected academic institutions for basic research
- Creating a National Experimental Mine for real-life testing and developing CMPDIL into a full-fledged research arm of the coal industry and supporting academic institutions for development of research manpower through funding of fellowships and research grants

Based on this study and analysis, the following generic recommendations are made for a coherent and synergistic national R&D programme for Indian minerals sector:

To be able to address effectively the many challenges that face the minerals sector in India, the investment in R&D in terms of funding and facilities need to be significantly enlarged. An annual budget of the order of Rs.6600 millions would be necessary which could be disbursed as under:

- Budgetary support to 2 National Laboratories and CMPDI and 5 Cooperative Research Centres - Rs.1500 million
- Funding mission-mode projects - Rs.3000 million
- Funding of extramural research in Universities - Rs.100 million
- Demonstration of new technologies in industry - Rs.2000 million/year
- Scholarships/Fellowships at Universities for human resource development for R&D - Rs.20 million/year

The funding for R&D could be generated through levy of a small cess of 1% on the value of mineral production. Capital investment for refurbishing and developing state-of-the-art facilities and creating new institutes will be of the order of Rs.2500 million.

- Industry's disinclination to R&D needs to be overcome and a consortia approach, analogous to the PPP model of CEMI of Canada, espoused so that industry collaborates in joint research projects with academe.
- To help identify the national research needs and develop a purposeful R&D agenda, a national advisory committee requires to be set up separately for coal and non-coal sectors with representation from industry, research institutes, academe and professional societies.
- To be abreast of developments in cutting edge technology and research around the world, twinning with research establishments abroad and participation in R&D projects would be desirable and needs to be actively pursued. India should strive to be a partner in the Global Mining Research Alliance (GMRA), created by Australian CSIRO, CANMET Mining and Mineral Science Laboratories in Canada, the NIOSH in the US and the Council for Scientific and Industrial Research in South Africa. The Alliance aims to become "the supplier of choice

for mining research solutions and knowledge in the international mining and resources industry” by pooling some of the world’s best research expertise and laboratory facilities.

- ICT could play a stellar role in mineral industry’s R&D agenda and should be a major component of every R&D project.
- An oversight process should be established to provide periodic independent evaluation of project management, performance schedule, cost controls and risks.

The roadmap is illustrated by concrete project outlines, their objectives, networked organizations and level of funding required. The study has been able to present a comprehensive assessment of the impacts of R&D on Indian mining industry performance which could help formulate future R&D initiatives of the industry. Indian minerals sector is entering a period of accelerating technological change and aggressive and purposeful R&D could help in gaining competitive advantage through the leverage of technology for sustainable competitiveness.

Water Resources Management

Water plays a critical role in meeting our needs in diverse fields – providing, *inter alia*, water for drinking, agricultural and industrial uses as well as maintaining the eco-system. India has a large irrigation network and has been in the forefront for establishing institutions and policies aimed at facilitating planned development of water resources, including a National Water Policy. Despite the continuing concerns and efforts, the water sector in India appears to be in a bind. Withdrawal of water at four times the rate it was 65 years ago to support a population of 1210 million (in 2010) at an enhanced level of nutrition, public health parameters and living standards is, to say the least, stressing the water capital. The ecosystem health has also been compromised severely. Realizing the seriousness and the importance of the water issues to our programmes for national well-being, INAE decided to undertake a research study to examine a few critical aspects of water supply and demand in various sectors and come up with implementable recommendations to overcome the lacunae in the water resources sector. Mr. SS Chakraborty is the Coordinator of this study group on “Water Resources Management” with Prof. S Mohan, Dr. RR Sonde, Prof. Subhash Chander and Dr. NK Tyagi as Members. The study assesses the demand for water from the various sectors of the economy, their trends and the potential shift from one sector to another in the light of the changes in the composition of the economy, the food security requirements, implications of changes in the lifestyle and other factors. This study analyses *inter alia* water availability, water quality and water demands in a few sectors along with the water-energy linkages, at river basin level.

India has a reasonably good endowment of water resources with an average rainfall of 1083 mm equivalent to 3560 billion cubic metre (BCM)/year. However, the available amount is substantially less and is estimated at 1869 BCM in the form of surface water and groundwater. Climate is one of the factors that is expected to disturb the hydrologic cycle. Preserving water quality is critical for sustained economic development and it is not a quality vs development issue. Degradation of water quality affects health and productivity, thereby impacting development activity adversely. This research study makes an effort to estimate the gap between supply and demand of water over the medium term up to 2025 and 2050, based on data available and taking cognizance of the uncertainties inherent in such estimations.

The common issues regarding surface and groundwater are salinity, toxicity and presence of pathogens. The specific problems relating to surface water are eutrophication, oxygen depletion and ecological health; groundwater specific issues are presence of fluoride, nitrate and arsenic contamination. As water quality standards differ with intended use, it is essential that while quantifying the degree of pollution, the standards and guidelines for use are kept in view. The overall gap in demand and supplies would not exist and the dependability of the system would be greatly enhanced after implementation of the various recommendations given below

(a) Supply Management

- Creation of large storages and linkages - It is planned to create additional live storage capacity of 170 BCM by 2050. Completion of the storage projects under construction by 2025 would provide live storage of 63 BCM.
- Large scale rehabilitation of irrigation works - Such an intervention would require renovation, de-silting and setting up of management infrastructure for irrigation works, creating an additional potential of 5 mha.
- Last mile irrigation infrastructure - This will set up the command area management structure and rehabilitate the system to bridge the gap of 9 mha (approx.) between the irrigation potential created and that utilized.
- Small scale irrigation infrastructure - Minor irrigation infrastructure projects, such as dams built closer to the community for using water during dry spells, will have a potential of irrigating 1.5 mha.
- Aquifer recharge - This would require construction of percolation tanks, check dams, contour bunds etc. to saturate the catchment area and increase abstraction efficiency to 90%, and recharge efficiency to 75%.
- Rain water harvesting - This involves harvesting rain water in the watersheds and using it for micro-irrigation in rain-fed cultivated areas. This will increase the yield of various crops by 25-40%.
- Use of waste water in irrigation - Recycling and reusing waste water, in lands near urban areas for irrigation and other purposes need to be ensured, through appropriate regulations, as necessary.
- National river linking project - At the national level, river linking should be accorded priority. Simultaneously initiatives at the regional levels have to be taken up in right earnestly for detailed studies and necessary follow up action

(b) Demand management - Technology interventions identified for maximizing productivity are listed below:

- Laser levelling - Use of laser levelling equipment for quicker and better levelling of the fields will contribute to water saving and increase water use efficiencies, besides reducing energy used in pumping water.
- Zero or minimum tilling - This technology involves direct planting of the crops without any or minimum tillage of lands. It not only reduces water use by 20-30%, but also reduces cost of cultivation, increases yield by 10-20% and decreases greenhouse gas emission.
- Sprinkler or drip irrigation - Use of sprinkler or drip irrigation saves 20-40% of water and increases yield by 10-40%.
- System of Rice Intensification (SRI) - This envisages transplanting seedlings of lesser age with more spacing and less water application only at saturation size.
- Land surface modification, bed and furrow irrigation and drainage - Bed and furrow irrigation permit growing of crops on beds with less water, reducing chances of plant submergence due to excessive rain.
- Biotic and abiotic stress management - The objective is to encourage better management of plant stress by optimum use of pesticides and innovative crop protection technologies.
- Improved germplasm - This would increase yield potential by using higher yielding seed varieties that are best adapted for specific conditions.

- Increased fertilizer use – This would involve increasing fertilizer use to reduce mineral exhaustion and improve yields in irrigated lands. The yield of all crops will increase by 25-50%.
 - Irrigation scheduling – The objective is to determine the exact amount of water for application to the field as well as the exact timing for application. The yield of all crops will increase by 5-20%, saving 10-15% of water.
 - Piped/lined water conveyance from tubewells – This reduces the losses in the conveyance system. Use of piped/lined water conveyance from tube-wells saves 20-40% water and increases yield by 10-40%.
 - Subsurface drainage – A subsurface drain is a perforated conduit of tile, pipe or tubing, installed below the ground surface to intercept, collect and/or convey drainage water. The yield would increase by 20-30%.
- (c) Water security for domestic, industrial and other requirements – The requirement of 261 BCM by 2025 and 373 BCM by 2050 will be met by utilizing perennial groundwater resources as well as from the storages created.
- (d) Sustainability of Ecosystems – The total environmental demands to maintain the ecosystem is estimated as 353 BCM. A scientific panel consisting of biologists, ecologists, geomorphologists and hydrologists needs to be constituted to assess the water needs after taking care of the species composition in the riverine wetlands. The panel would define the capacity to support and maintain a balanced, integrated, adoptive ecosystem having the full range of elements (genes, species and assemblages) and processes expected in the natural habitat of a region.
- (e) Institutions
- AIBP to be renamed as PABA – An effective institutional framework and sustained policy support are also required. The current Accelerated Irrigation Benefit Programme (AIBP) of the Govt. may be renamed as Programme for Accelerated Benefits for Agriculture (PABA) which may adopt the technologies for effective execution on the ground.
 - Development of water technology hubs – These hubs will be useful for benchmarking the available technologies to provide a clear picture of the benefits to private entrepreneurs.
 - Engaging local users in water management – All stakeholders, including members of the public, need to be given full opportunities to share their views and influence the outcome of water projects impacting them.
 - Strengthening technology diffusion network – The technology diffusion network needs to be strengthened. To start with, each Krishi Vigyan Kendra should have a water technologist.
- (f) Policy
- Climate change – Adaptation to climate change would require speedy action on implementation of supply and demand measures.
 - Private participation – Private participation in development and management of water resources, especially in large industrial clusters, needs to be encouraged.

INAE e-Newsletter

With effect from September 2009, INAE monthly electronic newsletter has been started replacing the erstwhile printed copies of quarterly newsletter. This monthly electronic newsletter contains engineering and technology updates and aspects of frontiers of engineering as well as the news regarding INAE activities. Inputs regarding technology updates are being taken from various sources such as journals/newsletters from DRDO, DAE, DOS, CSIR, S&T Report, Embassy of India in Japan and also from websites pertaining to technology review/updates. This also includes important innovative ideas, which can be absorbed for advancement of innovative engineering products. The monthly INAE e-Newsletter is being sent to the fellowship through email and is also uploaded on the INAE website.

Redesigning of INAE Website

One of the important activities planned as part of events/activities to celebrate Silver Jubilee Year was redesigning of the existing INAE website. The redesigned INAE website was launched on April 20, 2012. It comprises animated effects, flash banners, image gallery, new layout of the text pertaining to INAE activities and suitable pictures etc.

INAE Forums

Forum on Engineering Education

University-Industry Congress held on Nov 14-15, 2011 at New Delhi

University-Industry Congress was organized jointly by INAE, CII and AICTE during Nov. 14-15, 2011, at New Delhi. Mr. Kapil Sibal, Hon'ble Minister for MHRD was the Chief Guest. Academicians, representatives from major overseas universities, senior government officials and representatives of prestigious institutes like IITs and NITs participated in the event.

The following themes were covered

- (i) Whose Sakes are Higher in Academia-Industry Collaborations?
- (ii) Towards a Digital Highway
- (iii) Moving Towards Corporate Universities
- (iv) What does Industry want from Academia and What does Academia expect from Industry?
- (v) Companies inside Institutes and Research Partnerships.

Prof. PV Indiresan, Prof. R Natarajan, Prof. MS Ananth, Mr. SS Chakraborty, Prof. S Mohan, Dr. Rajeev Shorey and Dr. Alok Nath De from INAE made presentations. Prof. PV Indiresan chaired the session on "Whose Stakes are Higher in Academia-Industry Collaborations?", while Dr. Alok Nath De chaired the session on "Moving Towards Corporate Universities" and Prof. MS Ananth chaired the session on "Companies inside Institutes and Research Partnerships". Prof. R Natarajan spoke on the subject "What does Industry expect from Academia"; while Mr. SS Chakraborty gave his views on the subject "What does Academia want from Industry". Dr. Rajeev Shorey made a presentation on the subject "Towards a Digital Highway".

The pertinent issues discussed were on the disconnect between industry and academia; employability of engineering graduates; requirements of engineers in the 21st century; ways of increasing interaction between industry and academia; expectations of industry from academia and of academia from industry; incubation of start-up companies inside institutions and research partnerships.

AICTE proposal regarding introduction of a scheme to promote research in AICTE approved engineering colleges/institutions

INAE had received a proposal for introduction of a scheme to promote research in AICTE approved institutions from Chairman AICTE. The scheme is to be implemented by INAE with funding from AICTE. The objective of the scheme is to promote research culture amongst its faculty in AICTE approved institutions which could lead to the award of Ph.D. in the chosen field of study. The scheme envisages collaboration between INAE, various labs of CSIR, DAE, DRDO and DOS. In the beginning it is envisaged to support a few scholars in the age group of 25-35 years who would be placed in the above said labs to pursue research that could lead to award of Ph.D.

A meeting was held at INAE office on Nov 28, 2011 wherein guidelines for the operation of the proposed scheme and other relevant details were discussed. The salient points discussed included constitution of a Steering Committee comprising of experts from INAE, AICTE, CSIR, DRDO, DOS and DAE for planning and implementation of the proposed scheme. Relevant issues such as eligibility criteria, duration of Ph.D. programme, registration of candidates, remuneration, areas of Ph.D. programmes, number of candidates and admission procedure were also deliberated upon. It was decided during this meeting to get information from CSIR, DRDO, DOS and DAE regarding the disciplines of Engineering in which Ph.D. programmes can be offered and maximum number of candidates which can be accommodated during the first year of the proposed scheme. Relevant information has since been received from CSIR and the next meeting of the Committee will be held shortly.

Forum on Energy

Keeping in view the importance of energy issue, an INAE Forum on Energy has been constituted with Dr. Baldev Raj as Chairman and Dr. KV Raghavan, Dr. RR Sonde, Prof. SS Murthy, Dr. Ajay Mathur and Dr. Purnendu Ghosh as Members. This Forum has the mandate to address all issues related to energy.

INAE is a member of the CAETS Working Group for a project on "Deployment of Low Emissions Technologies for Electric Power Generation in Response to Climate Change" constituted during the year 2009. This Working Group comprised of ATSE, INAE, acatech, Canadian Academy of Engineering, Engineering Academy of Japan, South African Academy of Engineering and the Royal Academy of Engineering, UK. INAE Energy Forum submitted the report pertaining to India. Based on suggestions and positive response from the members, this Working Group was tasked to undertake the Second Phase of the Study on "The Challenges facing Low-Carbon Energy Technologies for Power Generation to 2050". INAE Report incorporating the inputs from the members of the INAE Energy Forum has been submitted to ATSE during Jan 2012.

An important activity undertaken by this forum is preparation of a comprehensive report on "INAE Recommendations on Energy and Sustainability for India". Two meetings of the Energy Forum have been held on Feb 15, 2011 at New Delhi and on Feb 22, 2012 at Thermax, Pune. This report is to be a concise document containing suitable actionable recommendations for the concerned Ministries/Departments on various relevant aspects in the field of energy such as projections/modelling/ data-supply and demand/gaps, dynamic models; technology assessment-methodology and infrastructural linkage; need for hybrid energy technology options; energy efficiency as an interface for all energy options; human resource challenges/mechanisms in energy for India; Research, Development & Deployment (RD&D) in specific domains and mechanisms for deployment; open access synergy – global/national; parity between electricity and other forms of energy; linked model for energy-water and food and final recommendations on Empowered Committee. This report is expected to be finalized shortly.

Forum on Microelectronics

INAE Forum on Microelectronics constituted during 2010 has the mandate to address all issues related to microelectronics and to appropriately network with other agencies concerned with this area.

One of the major activities undertaken by this Forum during the current year was to organize MOS-AK/GSA India2012 – International Workshop on Device Modelling of Microsystems during March 16-18, 2012 at Noida. This workshop was supported by Department of Information and Technology (DIT) and sponsored by major industries like IBM, Austriamicrosystems, Texas

Instruments, Mentor Graphics, Cadence, Freescale, STMicroelectronics and others. The aim of this Workshop was to provide a hi-tech forum to discuss the frontiers of device modelling for Microsystems with emphasis on simulation-aware models.

The specific workshop goal was to classify the most important directions for the future development of the microelectronic device models, not limiting the discussion to compact models, but including physical, analytical and numerical models, to clearly identify areas that need further research and possible contact points between the different modeling domains. This workshop was designed for device process engineers (CMOS, SOI, BiCMOS, SiGe) who are interested in device modeling; IC designers (RF/Analog/Mixed-Signal/SoC) and those starting in that area as well as device characterization, modelling and parameter extraction engineers.

The workshop also was envisaged to serve as a platform for launch of MOS-AK/GSA India which forum will help galvanize the microelectronics modeling community in India.

Five technical sessions followed by a Tutorial on CMOS Technology and SPICE Models were held on the third day. Ten posters presentations were made on the relevant topics. About 100 delegates from industry, R&D and academia participated in this workshop. Participation included industries like IBM, Texas Instruments, austriamicrosystems etc., R&D labs from DAE, CSIR and DRDO and academia like IIT, IIIT, NIT, CDAC, SMDP institutions all over the country. 20 speakers including 10 from overseas delivered talks during the workshop. The eminent speakers from abroad who presented papers were Mitiko Miura-Mattausch, Hiroshima University, Japan; Narain D. Arora, Silterra, Malaysia ; Ehrenfried Seebacher, AMS, Austria ; Xing Zhou, NTU, Singapore; Andre Juge (STM), France; Samar Saha, University of Colorado, USA ; Wladek Grabinski, MOS-AK/GSA, EU; Mike Brinson, London Metropolitan University, UK; Thomas Gneiting, ADMOS, Germany; and Yogesh Chauhan, UC Berkeley, USA.

Annual Convention

The Annual Convention of the Indian National Academy of Engineering was held on December 23-24, 2011 at Defence Metallurgical Research Laboratory, Hyderabad. The major scientific and engineering highlights of the Convention were the following technical presentations:

Presentations by Young Engineer Awardees 2011

- Dr. Subimal Ghosh : Projections of Finer Resolution Rainfall and Temperature in Climate Change Studies
- Dr. Vijay Natarajan : Topological Structures for Scientific Visualisation
- Dr. A. Chakraborty : Applications of Poroelectricity to Bone Modeling
- Dr. A. Arockiarajan : Experimental Characterization and Theoretical Studies on Electro-Mechanical Coupled Field Problems
- Niket S. Kaisare : Design and Control of Catalytic Microreactors for Fuel Processing Applications
- Dr. C. Roy Chaudhuri : Silicon Microchannel Based Immunosensor System with Portable Electronic Readout For Bacteria Detection
- Dr. Sudarshan Kumar : Development of Micro Combustion Systems: Insights through Computations and Experiments
- Dr. KV Rajulapati : Deformation Behaviour of Two Phase Materials at Nano Scale
- B. Madhan : Stability and Stabilization of Collagen: Applications From Leather to Biomedical Engineering

Presentations by newly elected Fellows

- Dr. Subrata Chowdhury : A Scientific Approach to Achieve the Target Strength of Fly Ash Based Concrete
- Prof. Umesh C. Kothiyari : Flow and Sediment Transport Through Vegetated Bed Channels
- Prof. Subrata Chakraborty : Efficient Robust Optimization of Structures
- Prof. D. N. Singh : Need Based Instrumentation for Various Geoenvironmental Issues
- Prof. A.N. Rajagopalan : Motion Blur: Some New Insights
- Prof. Subhash C. Mishra : Thermal Radiation – A Potential Deterministic Tool for Characterizing an Inhomogeneity
- Mr. K. Jayarajan : Advances in the Remote Handling Technology in Nuclear Industry

- Prof. Manas Chandra Ray : Effective Properties and Performance of a Novel Hybrid Smart Composite Reinforced with Radially Aligned Carbon Nanotubes on Piezoelectric Fibers
- Dr. J Raghava Rao : Greener Leather Processing: Paradigm Shift Through Engineering and Technological Advancements
- Prof. Amitava Dasgupta : Fabrication of RF MEMS switches in recessed CPW configuration on glass substrates
- Dr. K.J. Vinoy : Fractal Concepts for Antenna Design and Analysis
- Dr. R. M. Jha : Computational Electromagnetics Applications for Aerospace Engineering
- Mr. G. Satheesh Reddy : Evolution of Inertial Navigation
- Dr. Debabrata Basu : Bioceramics for Musculo-skeletal System: Implants/Devices to Drug Delivery
- Mr. R Natarajan : Technology Development of Fast Reactor Fuel Reprocessing in India

The 23rd Annual General Meeting of Fellows was held in the afternoon on Dec 23, 2011. During the Induction Ceremony, twenty five Fellows were formally admitted into the Academy. The Grand Award Ceremony was held at 5 PM on the same day.



*On the dais (From L to R)
Brig SC Marwaha, Dr. MJ Zarabi, Dr. RK Sinha, Dr. VS Arunachalam, Dr. Baldev Raj, Mr. SS Chakraborty, Dr. Dipankar Banerjee & Prof. Prem Krishna*

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 Ph.D. 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. Six candidates at Doctoral level, five at Master's level and nine at Bachelor level were given Innovative Student Projects Awards.

To recognize outstanding contributions made by young engineers to any branch of Engineering, the INAE Young Engineer Award was instituted in 1996 for engineering research, excellence in

*Dr. Dipankar Banerjee
receiving Prof. Jai Krishna
Memorial Award 2011 from
President, INAE*



*Dr. RK Sinha receiving Prof.
SN Mitra Memorial Award
2011 from President, INAE*



engineering design, technology development and technology transfer. Ten candidates were awarded INAE Young Engineer Award.

Prof. SN Mitra and Jai Krishna Memorial Awards are given to an eminent engineer, engineer-scientist or a technologist for academic and scholarly achievements in any discipline of technology. Prof Jai Krishna Award is given from among the disciplines of Civil Engineering, Mechanical Engineering, Chemical Engineering and Biotechnology, Aerospace Engineering and Mining, Metallurgical and Materials Engineering. Dr. Dipankar Banerjee, Professor, Department of Materials Engineering, Indian Institute of Science, Bangalore was conferred the Prof. Jai Krishna Memorial Award 2011. Prof S N Mitra Memorial Award is given from among the disciplines of Computer and Information Technologies, Electrical Engineering, Electronics & Communication Engineering, Engineering Nuclear Power and Energy Technologies and Interdisciplinary Engineering and



*Dr. VS Arunachalam
receiving the Life Time
Contribution Award 2011
from President, INAE*



*Mr. SS Chakraborty
receiving the Life Time
Contribution Award 2011
from President, INAE*

Technology. Dr. RK Sinha, Director, Bhabha Atomic Research, Mumbai was conferred the Prof. SN Mitra Memorial Award 2011.

The Lifetime Contribution 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. Dr. VS Arunachalam, Chairman, Centre for Study of Science, Technology and Policy (CSTEP), Bangalore; and Mr. SS Chakraborty, Managing Director, Consulting Engineering Services (India) Ltd., New Delhi were conferred Life Time Contribution Awards in Engineering 2011. Life Time Contribution Award lectures were delivered by Dr. VS Arunachalam and Mr. SS Chakraborty. Prof. Jai Krishna and Prof. SN Mitra Memorial lectures were delivered earlier in the day by Dr. Dipankar Banerjee and Dr. RK Sinha respectively.

The Fellowship

The following were elected for INAE Fellowship effective from Jan 1, 2012 by the Governing Council.

Engineering Section – I

1. Prof. Debasish Roy, Department of Civil Engineering, Indian Institute of Science, Bangalore
2. Mr. M Gopalakrishnan, Secretary General, International Commission on Irrigation & Drainage, Chanakyapuri, New Delhi

Engineering Section – II

- 1 Prof. Sanghamitra Bandyopadhyay, Machine Intelligence Unit, Indian Statistical Institute, Kolkata
- 2 Prof. Govindarajan Ramaswamy, Supercomputer Education & Research Centre, Indian Institute of Science, Bangalore

Engineering Section – III

- 1 Prof. K Balasubramaniam, Professor, Department of Mechanical Engineering and Head, Centre for NDE, Indian Institute of Technology Madras, Chennai
- 2 Prof. K Gupta, Department of Mechanical Engineering, Indian Institute of Technology Delhi, New Delhi
- 3 Prof. Anindya Chatterjee, Department of Mechanical Engineering, Indian Institute of Technology Kharagpur, Kharagpur.
- 4 Mr. Anil Kumar Sinha, Scientific Officer-H, Centre for Design & Manufacture, Bhabha Atomic Research Centre, Mumbai

Engineering Section – IV

- 1 Prof. Sirshendu De, Department of Chemical Engineering, Indian Institute of Technology Kharagpur, Kharagpur
- 2 Dr. BM Reddy, Senior Scientist, Indian Institute of Chemical Technology, Hyderabad

Engineering Section – V

- 1 Prof. HM Suryawanshi, Department of Electrical Engineering, Visvesvaraya National Institute of Technology, Nagpur
- 2 Prof. SV Kulkarni, Department of Electrical Engineering, Indian Institute of Technology Bombay, Mumbai

Engineering Section – VI

- 1 Prof. Navakanta Bhat, Electrical Communication Engineering Department, Indian Institute of Science, Bangalore

- 2 Prof. Shanthi Pavan, Department of Electrical Engineering, Indian Institute of Technology Madras, Chennai
- 3 Mr. S Varadarajan, Director, Electronics and Radar Development Estt. (LRDE), Bangalore

Engineering Section – VII

- 1 Prof. K Sudhakar, Department of Aerospace Engineering, Indian Institute of Technology Bombay, Mumbai
- 2 Dr. K Sivan, Project Director, RLV-TD Project, Vikram Sarabhai Space Centre, Thiruvananthapuram
- 3 Smt. Tessy Thomas, Project Director, AGNI, Advanced Systems Laboratory, Kanchanbagh, Hyderabad

Engineering Section – VIII

- 1 Prof. K Prasad Rao, Department of Metallurgical and Materials Engineering, Indian Institute of Technology Madras, Chennai
- 2 Dr. Shrikant V Joshi, Associate Director, International Advanced Research Centre for Powder Metallurgy and New Materials, Balapur, Hyderabad
- 3 Mr. HM Nerurkar, Managing Director, Tata Steel Ltd., Jamshedpur

Engineering Section – IX

- 1 Dr. Ram Kumar Singh, Outstanding Scientist, Reactor Safety Division, Bhabha Atomic Research Centre, Trombay, Mumbai
- 2 Mr. Anil V Parab, Vice President – Nuclear Power Plant Equipment Business, Heavy Engineering Division, Larsen & Toubro, Powai Campus, Mumbai

Engineering Section – X

- 1 Prof. SB Krupanidhi, Materials Research Centre, Indian Institute of Science, Bangalore
- 2 Prof. Prasun Kumar Roy, Director & Vice Chancellor (Offg.) National Brain Research Centre, Manesar, Gurgaon

Foreign Fellows 2012

- 1 Prof. Doraiswami Ramkrishna, H.C. Pfeffer Distinguished Professor of Chemical Engineering, School of Chemical Engineering, Purdue University, USA
- 2 Prof. Pradeep K Khosla, Dean, College of Engineering and Dowd University Professor, Carnegie Mellon University, USA
- 3 Prof. Venkatesh Kumar Kodur, University Distinguished Professor & Director (SAFE-D Centre), Dept. of Civil and Environmental Engineering, Michigan State University, USA.
- 4 Prof. Rakesh Agrawal, Winthrop E. Stone Distinguished Professor of Chemical Engineering, School of Chemical Engineering, Purdue University, USA.

Lectures and other events including those organized by Local Chapters

INAE Kolkata Chapter

To commemorate Engineer's Day celebration on Sep 15, 2011, INAE-Kolkata Chapter jointly with Center for Soft Computing Research, Indian Statistical Institute had organized a seminar lecture on "An Engineer's Revisit to Newton's Laws: Some Amazing Consequences" at CSCR Seminar Room, Main Building (R.A. Fisher Bhawan), Kolkata, which was delivered by Professor Amitabha Ghosh, BESU and Former Director of IIT Kharagpur. A large number of students, researchers and Faculty members of Indian Statistical Institute including the Fellows of INAE attended.

Annals of INAE

The Annals of the INAE containing the text of the lectures delivered by Life Time Contribution Awardees; Professor Jai Krishna and Prof. SN Mitra Memorial Awardees, newly elected Fellows of the Academy and INAE Young Engineer Awardees during the year has been printed and distributed to the Fellowship of the Academy.

INAE Silver Jubilee Year

During the Governing Council and AGM of Fellows, held on December 17, 2009 at Kalpakkam, it was brought out that INAE would be completing 25 year of its existence on April 11, 2012. It was decided to celebrate the Silver Jubilee year of the Academy commencing on April 11, 2012.

To plan the Silver Jubilee events of the academy, a committee under the Chairmanship of Dr. Anil Kakodkar was constituted. The first meeting of this committee was held on February 15, 2011 at New Delhi and the following decisions were taken.

- (a) Silver Jubilee Inaugural Function will be held on April 20, 2012 at New Delhi. The highlights of the Inaugural Function will include releases of INAE video film on Engineering in India, INAE coffee table book, INAE Study Reports; Silver Jubilee Distinguished Lectures; Silver Jubilee Young Engineer Awards and Addresses by the Presidents/Representatives of the member-academies of International Council of Academies of Engineering and Technological Sciences (CAETS).
- (b) The following events/activities would be organized during the Silver Jubilee Year :
 - (i) Silver Jubilee Distinguished Lectures
 - (ii) International Conference on "Towards a Better Innovation Ecosystem"
 - (iii) Symposium on National Frontiers of Engineering (NatFOE-7)
 - (iv) INAE – ATSE Workshop on Solar Thermal and Solar Photo Voltaic Technologies
 - (v) INAE-RAEng, UK Joint Theme Meeting on "Functional Materials and Structures"
 - (vi) India-Canada Joint Conference on Clean Coal Technology
 - (vii) Workshop on "Wireless, Mobile & Pervasive Systems"
 - (viii) INAE-Chinese Academy of Engineering Joint activity on "Digital Library"

Silver Jubilee Inaugural Function

INAE Silver Jubilee Inaugural Function was organized on April 20, 2012, at Indian National Science Academy (INSA) Auditorium, Bahadur Shah Zafar Marg, New Delhi. Dr. R Chidambaram, Principal Scientific Adviser to the Government of India was the Chief Guest. The function commenced with the address by Dr. Baldev Raj, President, INAE. He mentioned that the Academy has recently brought out comprehensive and exhaustive reports in selected areas of national interest and challenges, viz., healthcare technologies, civil infrastructure and water resources management. The Academy has also set-up three Forums, viz, INAE Forum on Engineering Education, INAE Forum on Microelectronics and INAE Forum on Energy. One of the focus areas of the Academy is to find innovative mechanisms to increase synergy among the fellows and nurture young leaders capable of meeting the challenges in future and advise policy makers to realize paradigm changes to solve the challenges in an inclusive fashion.

This was followed by the address by Dr. T Ramasami, Secretary, Department of Science & Technology, Government of India. He mentioned that there is a need to enhance the quality of

Dr. R Chidambaram, the Chief Guest inaugurating the Silver Jubilee Inaugural Function



Dignitaries on the dais (L-R) : Mr. LN Sharma, Dr. T Ramasami, Dr. R Chidambaram, Dr. Baldev Raj & Prof. René Dändliker



engineering education in the country. He brought out that though the number of engineering graduates has increased substantially in the past twenty five years, there is a need to improve the quality of engineering education. The Academy should play an important role in this area.

Prof. René Dändliker, President, International Council of Academies of Engineering and Technological Sciences, Inc. (CAETS) and Past President, Swiss Academy of Engineering Sciences (SATW), during his address mentioned that the primary objective of CAETS is to provide an independent nonpolitical and non-governmental international organization of engineering and technological sciences academies to advise governments and international organizations on technologies and policy issues related to its areas of expertise and contribute to the strengthening of engineering and technological activities in order to promote sustainable economic growth and social welfare throughout the world. He further brought out that during CAETS Annual Meeting and Symposium being held on Aug 29-31, 2012 at Zurich, the topics of discussion will be Nuclear



*Dr. Baldev Raj,
President, INAE
welcoming the guests*



*Dr. T Ramasami,
Secretary, DST
delivering his address*

Power: National Plans and Attitudes; Promoting Engineering-based Innovation; and Developing Regional Strategies for Adaption to the Effects of Climate Change. He also mentioned that in 2015, India shall be the host of CAETS Annual Assembly.

This was followed by the release of the INAE Coffee Table Book on "Glimpses of Indian Engineering Achievements" by Dr. R Chidambaram. The INAE Coffee Table book is a landmark document on the retrospect and prospect of Indian engineering. The book highlights notable engineering achievements of the country with the objective of creating awareness and inspiring a new generation of engineers. Brief descriptions and photographs have been included in the book in a manner that makes it interesting for the reader.

The research study reports on Technologies for Healthcare Sector in India, Assessment of Civil Engineering Inputs for Infrastructural Development and Water Resources Management were

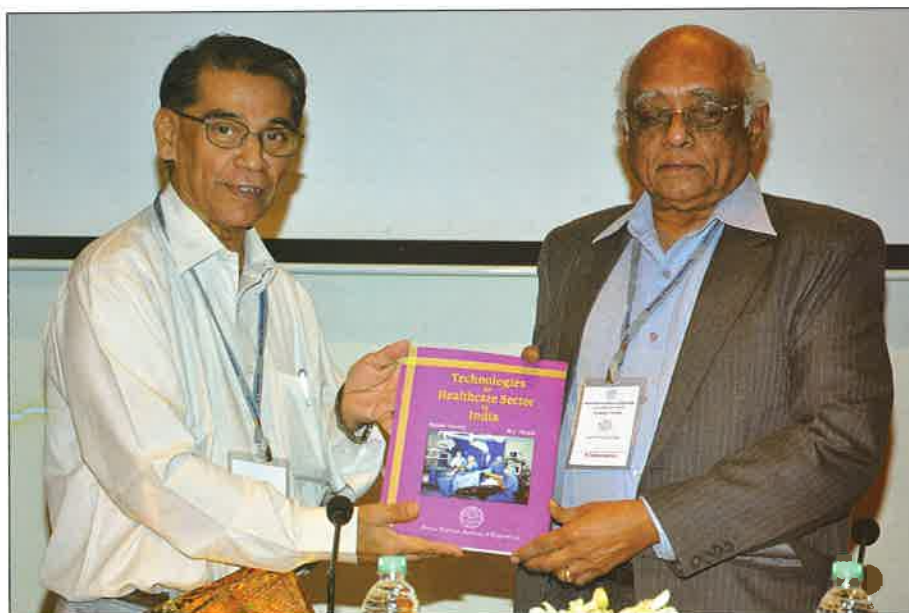
Prof. René Dändliker, President, CAETS delivering his address



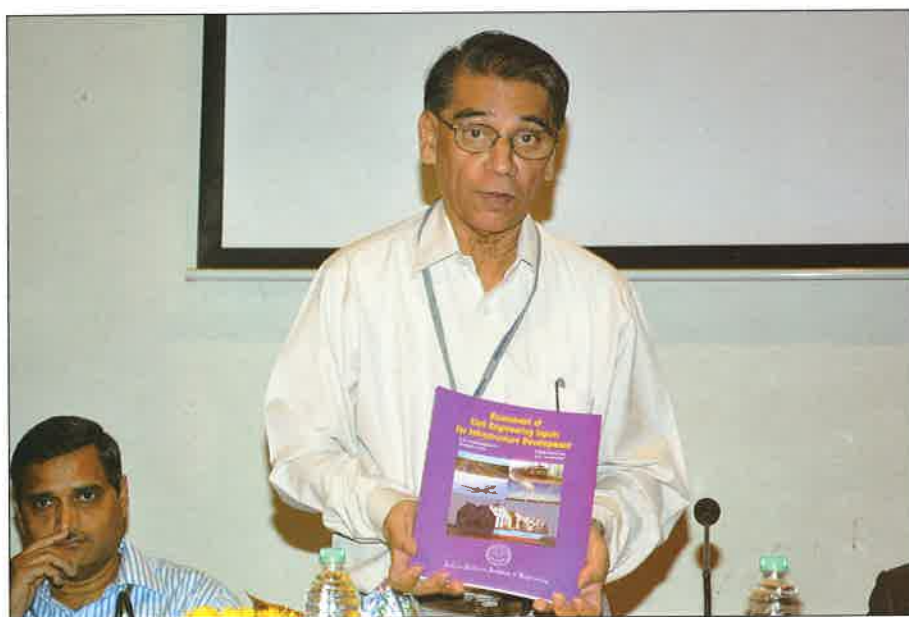
Release of INAE Coffee Table Book by Dr. R Chidambaram



released by Dr. T Ramasami. The research study on "Technologies for Healthcare Sector in India" addresses state of healthcare in India; role of engineering in healthcare sector; identification of priority areas; technologies for healthcare sector; cost-effective technologies for the Indian market; equipment available in India; challenges that lie ahead and how the healthcare sector can be improved with core recommendations. The objective of the Research Study on "Assessment of Civil Engineering Inputs for Infrastructural Development" is to create a position paper on Civil Engineering manpower available in the country at present and envision the needs for the ensuing immediate future. The research study on "Water Resources Management" assesses the demand for water from the various sectors of the economy, their trends and the potential shift from one sector to another in the light of the changes in the composition of the economy, the food security requirements, implications of changes in the lifestyle and other factors.



Release of Study Report on Technologies for Healthcare Sector in India by Dr. T Ramasami

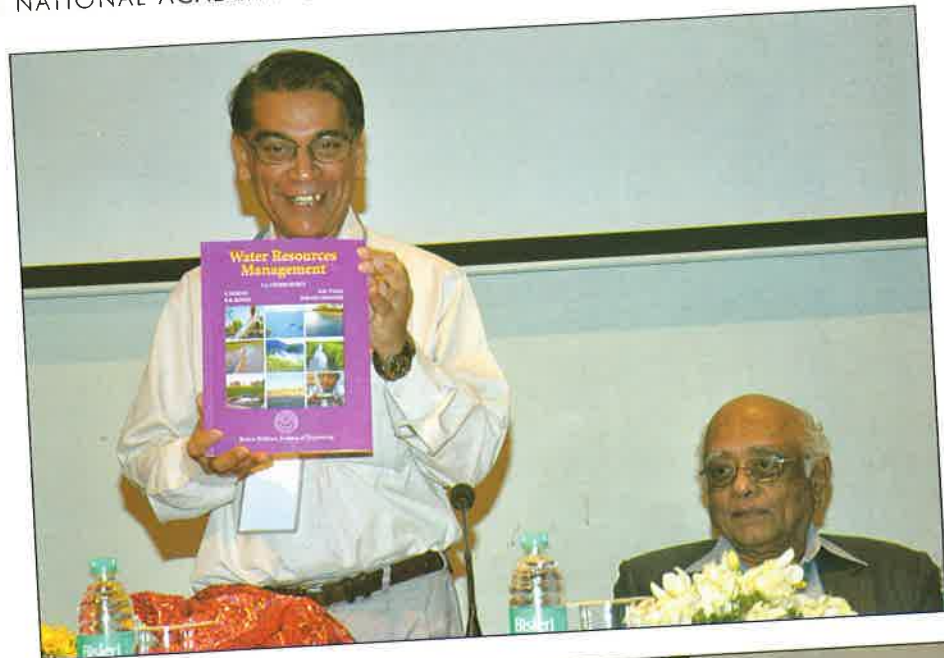


Release of Study Report "Assessment of Civil Engineering Inputs for Infrastructural Development"

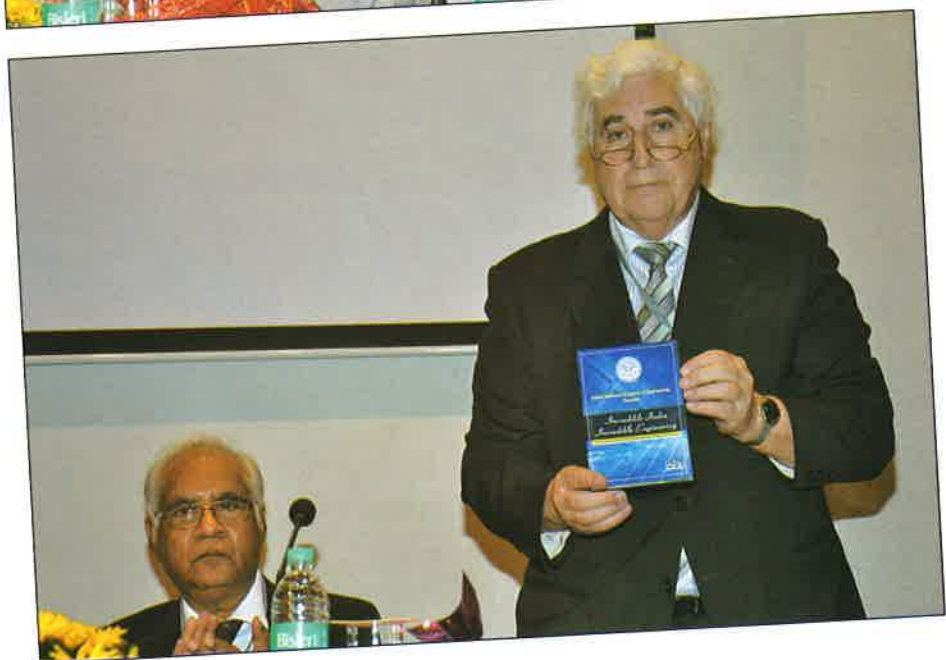
A video film to commemorate the INAE Silver Jubilee Celebrations was released by Prof. René Dändliker. This film showcases the engineering excellence of the country. The film covers a period from past and highlights contemporary achievements in various domains of engineering. The film highlights objectives, functioning, activities and contributions of INAE to the growth and excellence of the engineering profession in the country; since its inception in 1987. A Special Cover to commemorate the Silver Jubilee Year of INAE was released by Sh. L. N. Sharma, Postmaster General, Department of Posts.

The INAE Silver Jubilee Young Engineers Awards were presented by Dr. R Chidambaram to four young engineers below 45 years of age. The objective of the award is to recognize the outstanding engineering achievements/contributions made by them after receiving the awards from the academy when they were below 35 years of age. The awardees were Dr. Avinash Kumar Agarwal,

*Release of Study Report
on Water Resources
Management*



*Release of INAE Video
Film by Prof. René
Dändliker, President,
CAETS*



Associate Professor, Department of Mechanical Engineering, IIT Kanpur for his noteworthy research contributions in the areas of combustion phenomenon in IC Engines, reduction of automobile emissions, and non-conventional sources of energy; Prof. Sanghamitra Bandhopadhyay of Machine Intelligence Unit, Indian Statistical Institute, Kolkata for her pioneering contributions in the areas of evolutionary computation, pattern recognition, bioinformatics, data mining and multiobjective optimization; Prof. Sirshendu De of Department of Chemical Engineering, IIT Kharagpur for his significant research contributions in membrane separation processes and heat transfer modelling in micro-reactors and Dr. Sukumar Mishra, Associate Professor, Department of Electrical Engineering, IIT Delhi for his outstanding research contributions in the areas of power system engineering, intelligent techniques for control of power systems and renewable energy.



*Release of Special Cover
by Mr. LN Sharma,
Postmaster General,
Department of Posts*



*INAE Silver Jubilee
Young Engineer Award*

Dr. R Chidambaram, in his inaugural address mentioned that scientists create ideas which are converted into products by the engineers. He emphasized that the wealth of the nation depends on innovative technologies. He mentioned that India, through its Universities, Research Institutions, S&T Departments, including mission-oriented agencies (Atomic Energy, Space, Defence Research) has laid a strong foundation for basic research as well as applied research and technology development. For industrial development, we need in-house R&D centres in industry and enhanced academia-industry interactions, and for rural development, we need improved mechanisms for identifying relevant technologies and their rural technology delivery. He mentioned that the National Knowledge Network aims to connect all knowledge institutions in India through a high-speed all-optical fibre low-latency network. Regional and international research collaboration can be enhanced by connecting such Knowledge Networks. He further highlighted that the most important issue today, not only in India but everywhere, is attracting talented young people to careers in science

*Dr. R Chidambaram
delivering the
Inaugural Address*



*Prof. P Rama Rao
delivering the Silver
Jubilee Distinguished
Lecture*



and technology, particularly in those areas which a country considers important. INSPIRE programme of DST is a significant initial step in this context, starting from age group 10-15 (middle and high schools) to faculty awards in the age group 27-32 (post-doctoral). He mentioned that more than 6,40,000 awards have been released since the inception of programme in 2008. He urged the Academy to do more in chosen domains of engineering education and other national challenges.

The first INAE Silver Jubilee Distinguished Lecture was delivered Prof. P Rama Rao, Chairman, Governing Council, ARCI Hyderabad and former Secretary, Dept. of Science & Technology, Govt. of India. He explained in a lucid and comprehensive manner that the wealth and prosperity of a nation depend on the effective utilization of its human and material resources through industrialization (investment capital). The use of manpower resources for industrialization requires



*Dr. Anil Kakodkar
delivering the Silver
Jubilee Distinguished
Lecture*



*Dr. Baba N Kalyani
delivering the Silver
Jubilee Distinguished
Lecture*

education in science and training in technical skills. He mentioned that India being a vast country, diversity of governance systems is truly mind-boggling and unlike in any other country in the world. Government support to private institutions should be seriously considered. He correlated economic growth with relevant post-graduate and doctoral specialization.

The second INAE Silver Jubilee Distinguished Lecture delivered by Dr. Anil Kakodkar, DAE Homi Bhabha Chair, former Chairman, AEC and Secretary, DAE, Govt. of India was on the subject of securing the future of energy in India. He mentioned that securing India's future in energy is indeed a major challenge as India alone would need around 40% of present global electricity generation to be added to reach an average 5000 kWh per capita electricity generation. While solar energy represents a large enough energy source provided we can arrange adequate collection area, it would take a while to become commercially viable; nuclear energy is the only other large enough

clean and sustainable energy source. It is commercially viable and has been providing around a sixth of global electricity for decades. Also it does not emit carbon dioxide. However, our uranium resources are very modest. He highlighted the importance of recycling in fast spectrum reactors and thorium utilization. With reprocessing and recycle, energy potential is enhanced several times and even our modest uranium resources represent an energy source larger than coal. Reprocessing and recycle with fast reactors also enables use of thorium which is abundant in India. Thorium also offers many advantages such as; high burn up, capacity, reduced minor actinides production, higher safety margins, higher proliferation resistance etc. India has a unique opportunity as eventually thorium would assume importance worldwide. He iterated that while we must make full use of all available energy resources, only three stage programme of DAE and solar energy are sustainable in the long run as far as India is concerned.

The third INAE Silver Jubilee Distinguished Lecture was delivered by Dr. Baba N Kalyani, CMD, Bharat Forge Ltd., Pune. He mentioned that while China would be second largest economy in the world, India will be third largest economy. There is a dire need for Indian Industry to invest in R&D rather than importing technologies from abroad. For this, the need for indigenous manufacturing technology is vital. He mentioned that advanced economies and emerging economies are on diverging trajectories. Emerging countries generally have favourable demographics (except China on a relatively longer horizon) with prospects of modest to high GDP growth. The world's economic centre of gravity will shift towards emerging countries like India in the years to come. He highlighted the importance of high level human expertise, proper policies and need based products.

One of the highlights of the function was participation by Presidents/representatives of the member-academies of CAETS. The first presentation was by Prof Robin Batterham, President, Australian Academy of Technological Sciences and Engineering (ATSE) who mentioned that a CAETS Working Group on Low Carbon Technologies was constituted which comprised of member academies from Australia, Canada, Germany, India, Japan, Korea, South Africa and UK. The CAETS Energy report had come up with clear recommendations on improved efficiency of energy end use and means of promoting efficient usage globally; research, development and commercialisation of carbon capture and storage technologies and new technologies for electricity distribution networks. He highlighted the importance of close working of Chinese and Indian Academies on areas of mutual interest and enhancing the collaborations. This was followed by a presentation by Prof Gan Yong, Vice President, Chinese Academy of Engineering. The next presentation was by Dr. Ainomaija Haarla President, Technology Academy Finland who mentioned that the mission of their Academy is to promote innovations that improve the quality of people's lives; to enhance networking of Finnish technology companies, governmental bodies and the academic community and other national engineering academies and to inspire young people to choose a career in technology and the natural sciences is close to the priorities of INAE. This was followed by a presentation by Dr. Arthur Ruf, Vice President & Head of foreign relations, Swiss Academy of Engineering Sciences (SATW). The last presentation was by Ir. Bertrand van Ee, President, Netherlands Academy of Technology and Innovation who highlighted that the objective of their Academy is to be the meeting and network place for high level decision makers and experts; to positively influence society's attitude to technology and innovation and to advance favourable climate for innovation in the Netherlands through innovation conferences. All the Academies expressed keen interest in activities of INAE and enhancing collaborations.

The function was a big success and was appreciated by all participants. Live webcast of the whole day's events was very well received and appreciated by a number of INAE Fellows within India and overseas who were not able to attend the function. The event was followed by dinner at India International Centre. The video recording of the event and the presentations under the INAE Distinguished Lecture series have been posted on INAE website.

Honours and Awards

Republic Day Award

The following INAE Fellows have been conferred with the prestigious award of Padma Shri by the Hon'ble President of India on Republic Day, Jan 26, 2012.

- (a) Dr. V Adimurthy
- (b) Dr. LK Singhal
- (c) Dr. YS Rajan

Other Awards

- 1 Dr. Baldev Raj, President-Research, PSG Institutions, Coimbatore was conferred with 10th Indian Nuclear Society Homi Bhabha Lifetime Achievement Award for the year 2010; H.J Bhabha Gold Medal and Memorial Award by Indian Science Congress, 2012; Honorary Professorship of Sichuan University, Chengdu, China; and Honorary Fellowship of the Australian Institute of High Energetic Materials. He was also conferred with the JC Bose Fellowship by Department of Science & Technology, Ministry of Science and Technology, New Delhi in recognition of his active outstanding performance and contribution to science.
- 2 Dr. Sanak Mishra, Vice President of ArcelorMittal, CEO, Greenfield Projects India, ArcelorMittal India Ltd. New Delhi was selected to receive the 2011 IIM-Platinum Medal which was awarded during the Inaugural function of the 49th National Metallurgists Day Celebrations and 65th Annual Technical Meeting of the Institute held on Nov 13, 2011 at Hyderabad.
- 3 Capt NS Mohan Ram, Adviser, TVS Motor Company Ltd., Hosur was selected for the prestigious Distinguished Alumnus Award 2011 of IIT Kharagpur which was awarded to him during 57th Convocation of IIT Kharagpur held on August 18, 2011. He has also been conferred with has been conferred with VASVIK Award in the category of Mechanical & Structural Sciences & Technology
- 4 Prof. P.K. Dash, Director (Research & Consultancy), Multidisciplinary Research cell, Siksha O Anusandhan University, Bhubaneswar was awarded the Biju Patnaik Award for Scientific Excellence for the year 2010 by the Orissa Bigyan Academy for his contributions in the field of scientific research.
- 5 Prof. B.L. Deekshatulu, Chairman NIT Warangal (AP), Distinguished Fellow IDRBT (RBI-Govt. of India), Visiting Professor JNTU Kakinada was conferred with the National Award by Ministry of Earth Sciences, Govt. of India on July 27, 2011 for his outstanding Contributions to Ocean Science & Technology. He was also conferred with the CHEN Shupeng award on Oct 3, 2011 by the Chinese National Committee for Remote Sensing/ Asian Association for Remote Sensing (AARS) for his outstanding contributions to Remote Sensing and to the AARS, at Taipei.
- 6 Dr. RV Jasra, Senior Vice-President, Head, Reliance Technology Group, Vadodara was conferred with the prestigious VASVIK Award in the field of Chemical Sciences &

Technology. The award was presented by Hon'ble Chief Minister of Gujarat, Shri Narendra Modi during the function hosted by Charotar University of Science and Technology at Changa, Dist. Anand held on October 7, 2011.

- 7 Prof. Vikram Kumar, Department of Physics & Centre for Applied Research in Electronics (CARE), IIT Delhi was selected for the MRSI Distinguished Materials Scientist of the year 2012 Award.
- 8 Prof. Anupam Basu, Dept. of Computer Science & Engineering, IIT Kharagpur was selected for the NCPEDP – Mphasis Universal Design Award 2011 in recognition of his work towards the cause of accessibility. The award was given at a ceremony held on 14th August, 2011 in New Delhi
- 9 Prof. DN Singh, Dept of Civil Engineering, Indian Institute of Technology Bombay, Mumbai was conferred with John R. Booker Excellence Award 2011 by International Association for Computer Methods and Advances in Geomechanics (IACMAG) in recognition of his contributions for advancement of research, education and practice of Environmental Geotechnology and development of novel techniques to simulate contaminant transport in geomaterials, under laboratory and in-situ conditions. This honour was given during the award ceremony held on 10th May 2011 at Melbourne
10. Prof. V Rajaraman, Honorary Professor, Supercomputer Education and Research Centre, Indian Institute of Science, Bangalore has been awarded DSc (Honoris Causa) by the Bengal Engineering and Science University, Shibpur for his contribution to engineering, in the convocation held on Feb.22, 2012. He was also given the life time achievement award by the Computer Society of India at their national convention in 2011.
- 11 Dr Kalyanmoy Deb, Professor, Department of Mechanical Engineering, IIT Kanpur has been conferred with the Infosys Prize 2011 for his outstanding work in the fields of evolutionary multi-objective optimization and genetic algorithms.

News of Fellows

- 1 Dr. Baldev Raj, President, INAE and Former Director, Indira Gandhi Centre for Atomic Research, Kalpakkam had been chosen for conferment of 'Honorary Fellowship' by International Medical Sciences Academy (IMSA) in recognition of his outstanding academic, research and professional achievements. He was conferred with the 'Honorary Fellowship' during the Annual Conference of IMSA held on Nov 4-5, 2011. He had also been selected as Erudite Visiting Professor of Mahatma Gandhi University, Kottayam, Kerala; Distinguished Visiting Professor at IIT, Bombay, Mumbai; Distinguished Visiting Professor at IIT, Kharagpur. He also delivered Distinguished Nayudamma Memorial lecture of C S I R.
- 2 Dr. M J Zarabi, Vice-President INAE and Formerly Chairman-cum-Managing Director, Semiconductor Complex Ltd., SAS Nagar was selected as member of the Empowered Committee constituted by the government for setting up of two Semiconductor Wafer Fabrication facilities, envisaging an investment of up to Rs 25,000 crore. The other members of the committee are Advisor to PM on Public Information, Infrastructure and Innovation; Chairman of National Manufacturing Commission; Secretary, Department of Expenditure and Member (Industry), Planning Commission.
- 3 Dr. Sanak Mishra, Vice President of ArcelorMittal, CEO, Greenfield Projects India, ArcelorMittal India Ltd. New Delhi has been appointed by the Ministry of Steel, Govt. of India as Co-Chairman of the Review Committee for the project on Futuristic Iron Production with minimum or zero carbon dioxide emission.
- 4 Dr. Surendra Pal, Prof. Satish Dhawan Professor & Senior Adviser, Satellite Navigation, ISRO Satellite Centre, Bangalore delivered invited talks and tutorials on Radar Systems,

Microstrip Antennas for Radars, Satellite Communication, Small Satellites, GNSS, Antennas for Space Communications, Perspectives in Space Communications, Communication Satellites during his visits to NTU Singapore during Feb-March 2011. He also delivered invited talks during his visit to University of Cape-Town, Cape Peninsula Technical University, Stellen Bash University. CSIR and DST Govt. of Republic of South Africa (Johanneserg and Pretoria) during April 2011.

- 5 Prof. J Nanda, INSA Honorary Scientist, Department of Electrical Engineering, Indian Institute of Technology, New Delhi was the Chief Guest on the Engineer's day celebrated by National Thermal Power Corporation (NTPC) on the occasion of the birthday of Bharat Ratna, Sir M. Visweswaraya on 15th Sept.2011 wherein he was felicitated by NTPC and he addressed the engineers on Power Scenario in the country, Environment, Sustainable energy, Smart Grid and Challenges ahead.
- 6 Prof. SN Mukhopadhyay, Dept. of Biochemical Engineering and biotechnology, Indian Institute of Technology Delhi has authored a book titled "Process Biotechnology Fundamentals" published by Viva Books, New Delhi.
- 7 Dr. Sukumar Mishra, Associate Professor, Department of Electrical Engineering, Indian Institute of Technology, New Delhi has been elected as Fellow of The Institution of Engineering and Technology (IET), UK w.e.f. April 2011.
- 8 Mr. G Satheesh Reddy, Scientist 'G' & Director, Inertial Systems, RCI, DRDO, Hyderabad has been promoted as 'Outstanding Scientist' by the Government of India.
- 9 Prof. B.L.Deekshatulu, Chairman, NIT Warangal (AP), Distinguished Fellow IDRBT (RBI-Govt. of India), Visiting Professor JNTU Kakinada has been elected Hon. Member of Asian Association for Remote Sensing (AARS) on Oct 4, 2011.
- 10 Ms. Alpa Sheth, FNAE & Managing Director, VMS Consultants Pvt. Ltd.; Prof. CVR Murty, FNAE Indian Institute of Technology Madras and Dr. Durgesh C Rai, FNAE Indian Institute of Technology Kanpur have contributed a report on the M 6.9 Sikkim Earthquake of September 18, 2011. It is published in the Earthquake Engineering Research Institute (EERI) Newsletter, November 2011 Volume 45, Number 11 Issue at Page 6. This can be viewed by clicking on the link below:
<http://www.eeri.org/wp-content/uploads/Nov11.pdf>
- 11 Prof. C Venkatesan, Department of Aerospace Engineering, Indian Institute of Technology, Kanpur has been elected as Associate Fellow of American Institute of Aeronautics and Astronautics (AIAA.) and he was presented with Certificate of the AIAA during the 50th AIAA Aerospace Sciences meeting in Nashville, Tennessee, USA during January 2012.
- 12 Dr. V Ramaswamy, Department of Metallurgical Engineering, PSG College of Technology, Coimbatore was selected as Honorary Member of the Indian Institute of Metals which was conferred during the National Metallurgists day celebrations at Hyderabad held on Nov. 13, 2011.
- 13 Dr. Kalyanmoy Deb, IIT Kanpur, Dr. K. Gopakumar (Section V), IISc Bangalore; Dr. Ranjan K. Mallik (Section VI), IIT Delhi; Dr. Sushmita Mitra (Section II), ISI Calcutta; Dr. C. Sivaram Murthy (Section II), IIT Madras; and Dr. Raghunath K. Shevgaonkar (Section VI), IIT Delhi (Director, IIT Delhi) have been elected IEEE Fellows w.e.f. January 2012.
- 14 Dr. Bhakta B Rath, Associate Director of Research, Materials Science and Component Technology Directorate, Naval Research Laboratory, USA has been elected as Fellow of The American Association for the Advancement of Science (AAAS) in recognition of his outstanding contributions in materials science and engineering and for leadership in advancing research and technology to support national security.

Governing Council

1. Dr. Baldev Raj, President-Research, PSG Institutions, Coimbatore.
2. Dr. PS Goel, Chairman, Recruitment & Assessment Centre, DRDO, Ministry of Defence
3. Dr. MJ Zarabi, Formerly Chairman-cum-Managing Director, Semiconductor Complex Ltd., SAS Nagar, Chandigarh
4. Prof. Prem Krishna, Formerly Professor & Head of Civil Engg., IIT Roorkee
5. Dr. KV Raghavan, INAE Distinguished Professor, Reaction Engineering Laboratory, IICT, Hyderabad
6. Prof. AK Ghose, Formerly Director, Indian School of Mines, Dhanbad
7. Shri VK Agarwal, Formerly Chairman, Railway Board & Ex-officio Principal Secretary, Govt. of India
8. Dr. AL Rao, Former Chief Operating Officer, Wipro Ltd., Bangalore
9. Capt NS Mohan Ram, Adviser, TVS Motor Company Ltd., Hosur.
10. Dr. CR Prasad, Chairman & Managing Director, Everest Power Private Limited, New Delhi
11. Prof. PK Dash, Director, Research & Consultancy, Siksha 'O' Anusandhan University, Bhubaneswar
12. Prof. Ranjan K Mallik, Department of Electrical Engineering, Indian Institute of Technology Delhi
13. Dr. BN Suresh, Member, Space Commission and Director, Indian Institute of Space Science & Technology (IIST), Trivandrum
14. Dr. CG Krishnadas Nair, Honorary President, SIATI, Vice-Chancellor, MATS University, Bangalore
15. Mr. HL Bajaj, Technical Member, Appellate Tribunal for Electricity, New Delhi
16. Prof. Damodar Acharya, Director, Indian Institute of Technology, Kharagpur

Government Representatives

17. Ministry of Science & Technology : Dr. V Rao Aiyagari, Advisor, Public Health Foundation of India, New Delhi
18. Department of Atomic Energy : Dr. LM Gantayet, Distinguished Scientist and Director, Beam Technology Development Group, Bhabha Atomic Research Centre, Mumbai
19. Representative of All India Council for Technical Education : Prof. DV Khakhar, Indian Institute of Technology, Bombay, Mumbai

Representative of Cooperating Academies

20. Indian National Science Academy : Prof. NK Gupta, Henry Ford Chair Emeritus Professor, IIT Delhi
21. Indian Academy of Sciences : Prof. Surendra Prasad, Former Director, Indian Institute of Technology, Delhi
22. National Academy of Sciences (India) : Prof. Ashok Misra, Chairman, Intellectual Ventures, Bangalore
23. Indian Science Congress Association : Dr. P Rama Rao, ISRO Dr. Brahm Prakash, Distinguished Professor, ARCI, Hyderabad
24. Asiatic Society : Prof. Basudeb Barman, Former Member of Parliament, Lok Sabha and Formerly Vice-Chancellor, University of Kalyani

Professional Bodies

25. The Institution of Engineers (India) : Lt Gen VJ Sundaram, Retd., Advisor, Micro & Nano Systems, National Design & Research Forum, Bangalore

Representative of Industry

26. Confederation of Indian Industry (CII) : Mr. Anjan Das, Executive Director – Technology, CII, New Delhi

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Prof. Prem Krishna

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Mr. SS Chakraborty

JS&FA, DST

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Prof. BS Murty
Mr. KK Sinha
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Prof. Prasenjit Sen
Prof. Kehar Singh
Dr. V Aiyagari Rao
Dr. U Kamachi Mudali

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Contribution Award in Engineering,
Professor Jai Krishna Memorial Award
and Professor SN Mitra Memorial Award**

Chairman

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Members

Prof. Prem Krishna
Dr. MJ Zarabi
Dr. KV Raghavan

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Prof. JM Vasi
Mr. AS Kiran Kumar
Dr. G Venkatesh

Forum on Energy

Chairman

Dr. Baldev Raj

Members

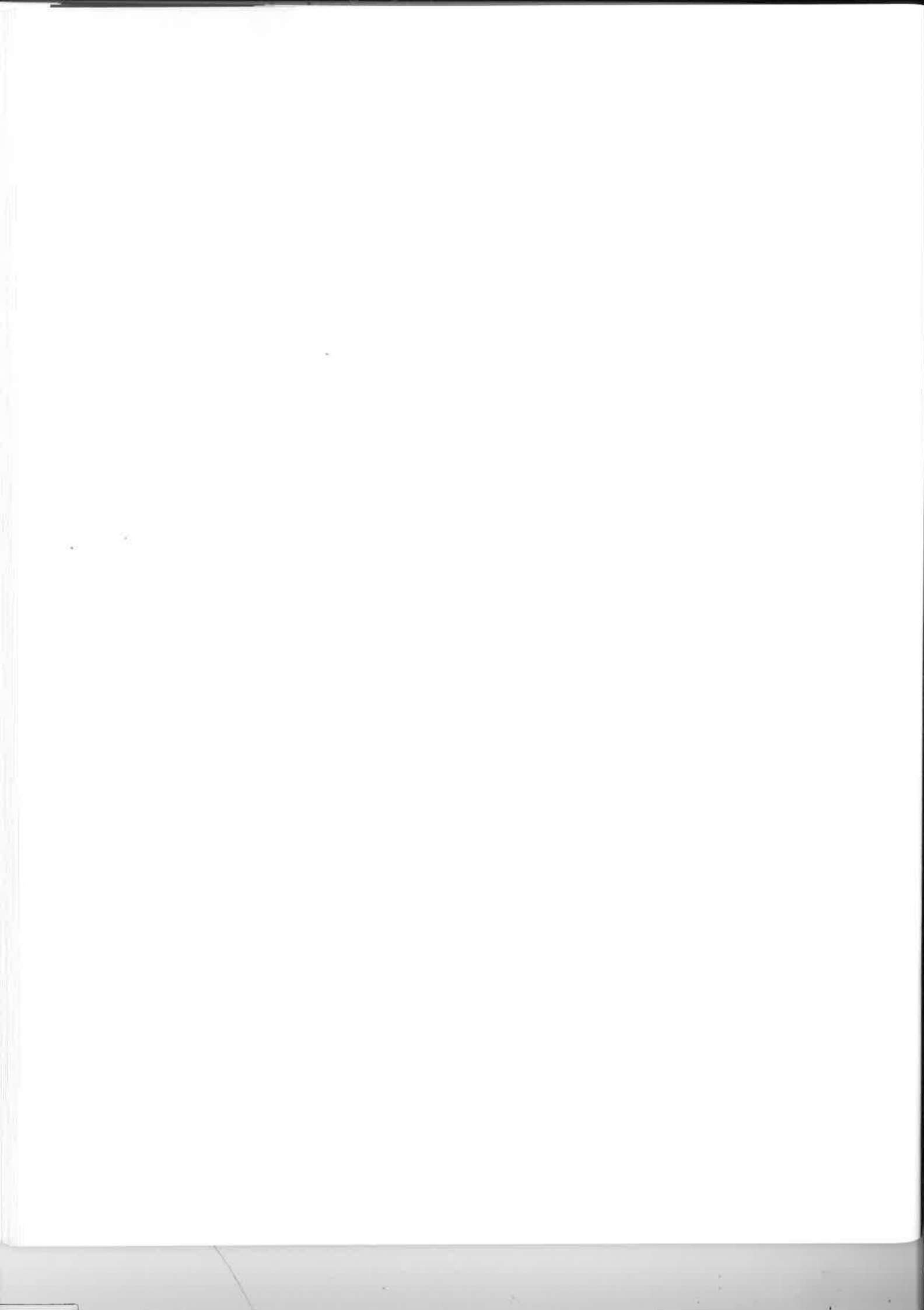
Dr. KV Raghavan
Dr. RR Sonde
Prof. SS Murthy
Dr. Ajay Mathur
Dr. Purnendu Ghosh

Statement of Accounts

2011-12



INDIAN NATIONAL ACADEMY OF ENGINEERING



MEHRA MALHOLRA & CO.
CHARTERED ACCOUNTANTS

Phone : 25733778
16/A/7 W.E.A.
KAROL BAGH
NEW DELHI-110 005

THE MEMBERS
INDIAN NATIONAL ACADEMY OF ENGINEERING
NEW DELHI – 110 016

AUDITORS REPORT

We report that we have audited the Balance Sheet of INDIAN NATIONAL ACADEMY OF ENGINEERING as at March 31, 2012 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.

Subject to the above :

- i) We have obtained all the 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 the 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, 2012; 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 31, 2012.

For MEHRA MALHOTRA & CO
CHARTERED ACCOUNTANTS
(Sd/-)
(ARUNKUMAR MEHRA)
PARTNER
(Membership No. 80827)
(Reg. No. 001052N)

Place : New Delhi
Dated : July 27, 2012

BALANCE SHEET AS AT 31ST MARCH, 2012

(Amt in Rs)

	As at 31.3.2012	As at 31.3.2011
CORPUS/CAPITAL FUND AND LIABILITIES		
GENERAL FUND	2,51,50,879	2,06,83,806
EARMARKED FUNDS	3,84,37,933	2,57,91,917
CURRENT LIABILITIES AND PROVISIONS	65,80,666	49,31,223
TOTAL	7,01,69,478	5,14,06,946
ASSETS		
FIXED ASSETS	6,08,809	7,09,363
INVESTMENTS	6,26,19,266	4,51,25,303
CURRENT ASSETS, LOANS & ADVANCES	69,41,403	55,72,280
TOTAL	7,01,69,478	5,14,06,946

As per our report of even date

On behalf of the Council:

For MEHRA MALHOTRA & CO
CHARTERED ACCOUNTANTS

Sd/-
(Dr. Baldev Raj)
President

Sd/-
(ARUN KUMAR MEHRA)
Partner
(Membership No. 80827)
(Reg. No. : 001052N)

Sd/-
(Dr. MJ Zarabi)
Vice-President (Finance & Establishment)

Place : New Delhi
Dated : July 27, 2012

Sd/-
(Brig SC Marwaha)
Executive Secretary

Sd/-
(Bhuwan Adhlakha)
Manager (F & A)

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2012

(Amt in Rs)

	Current Year 2011-12	Previous Year 2010-11
INCOME		
Grants and Sponsorships	4,09,22,420	3,29,65,601
Delegate Registration Fees etc.	21,54,411	3,11,924
TOTAL	4,30,76,831	3,32,77,525
EXPENDITURE		
(1) Engineering Activities		
i) Seminars / Conferences / Symposiums / Workshops	1,30,46,345	34,41,981
ii) INAE Chair , Distinguished Professors & Mentoring Schemes	47,91,178	56,54,183
iii) Research Studies/ Projects	27,28,157	51,08,372
iv) INAE Awards	31,92,704	35,91,999
v) Academia-Industry Interaction	16,00,305	16,78,262
vi) INAE Forums	1,13,302	2,07,025
vii) Academy Meetings	13,73,038	11,04,940
viii) Annual Convention	5,76,041	15,18,754
ix) International Affairs	11,68,497	15,56,742
x) INAE Publications	17,62,908	18,81,813
xi) Financial Assistance for Engineering Activities	4,07,600	60,500
xii) INAE Silver Jubilee Activities	29,42,093	-
(2) Establishment expenses	74,57,393	72,24,756
(3) Depreciation	1,59,704	1,90,870
(4) Disposal of Assets	-	7,873
(5) Transfer to General Fund	17,57,567	49,455
TOTAL	4,30,76,831	3,32,77,525

As per our report of even date

On behalf of the Council:

For MEHRA MALHOTRA & CO
CHARTERED ACCOUNTANTS

Sd/-
(Dr. Baldev Raj)
President

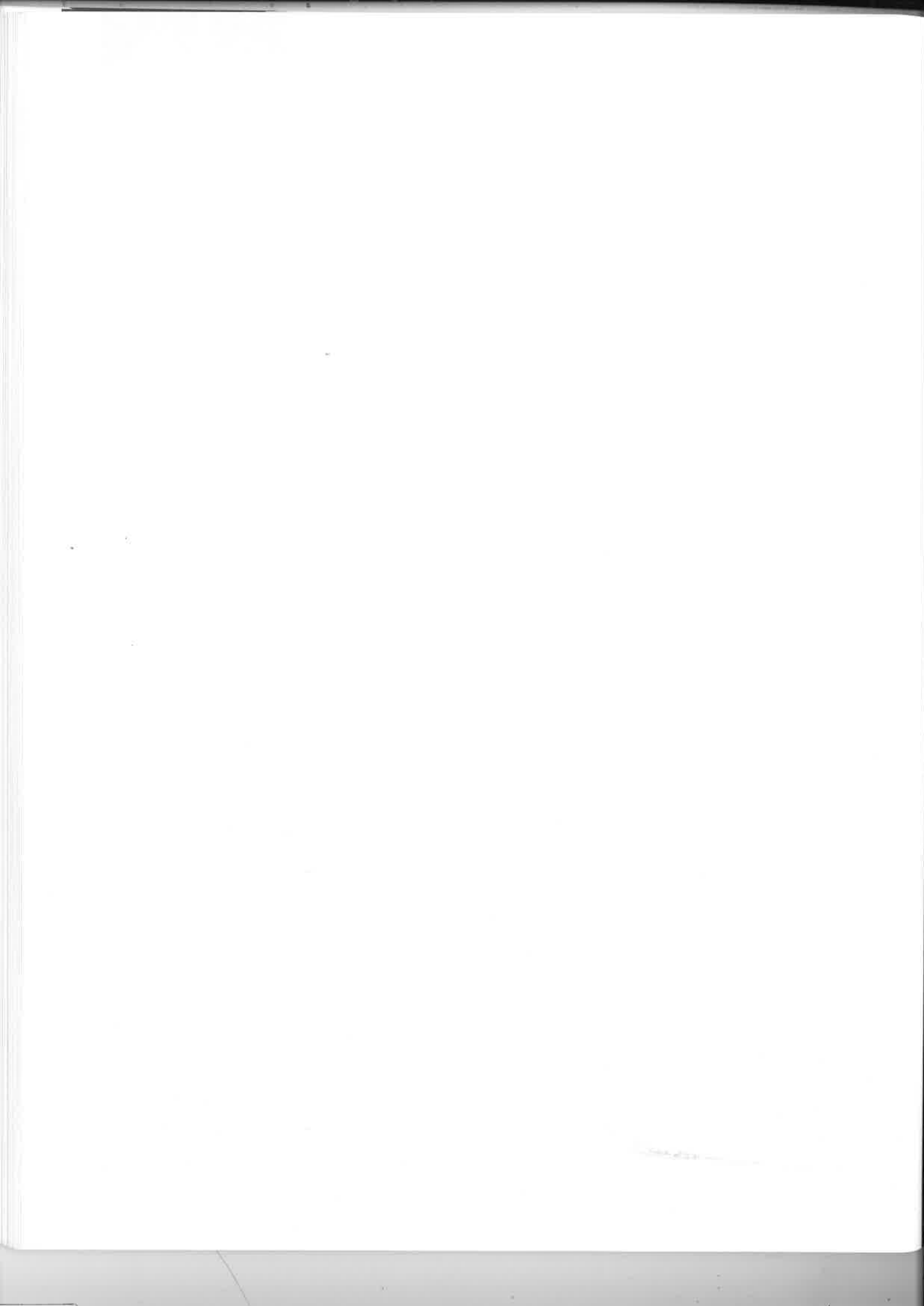
Sd/-
(ARUN KUMAR MEHRA)
Partner
(Membership No. 80827)
(Reg. No. : 001052N)

Sd/-
(Dr. MJ Zarabi)
Vice-President (Finance & Establishment)

Place : New Delhi
Dated : July 27, 2012

Sd/-
(Brig SC Marwaha)
Executive Secretary

Sd/-
(Bhuwan Adhlakha)
Manager (F & A)



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Url : <http://www.inae.org>

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Act 1860 (XXI of 1860) No: S-17673 of 20
April 1987

Bankers :

State Bank of India, JNU Branch
New Delhi (India)
State Bank of India, IP Estate Branch
New Delhi (India)

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