Dear Reader,

Time and again we have received suggestions from alumni and friends regarding restructuring the newsletter “Grapevine”. Based on these inputs and from our own internal feedback, from this issue of Grapevine onwards we have divided the news into the following 6 categories: Happenings at the Institute, Support from Alumni and Friends, Achievements, Student initiatives, Institute initiatives and Profiles. We have already been reporting the first three sections under different headings. In the new categories, the student initiatives section will report about research projects, community development projects etc. carried out by students; the Institute initiatives section will report about the initiatives taken by the Institute for various causes; and the profiles section will cover information not only about faculty, staff and students but also report on new laboratories etc. We request you to give us your feedback and suggestions for improving the newsletter further.

Happenings at the Institute

Convocation 2012

The 44th Convocation of the Institute was held on 2nd June, 2012. The Chief Guest for the event was Dr. E. Shreedharana, Padma Vibhushan, former Managing Director of Delhi metro rail corporation (DMRC). Prof. M. Anandakrishnan, the chairman of the board of governors, IIT-Kanpur was also present at the ceremony. A record 1135 students graduated this year. The Doctor of philosophy degree was awarded to 101 students, the BTech degree was awarded to 340 students, the BTech/MTech dual degree was awarded to 123 students, 320 students were awarded the MTech degree, 26 students were awarded the MBA degree and 34 students were awarded diploma in visionary leadership for manufacturing Programme. The prestigious President's Gold Medal, given to the student with the best academic performance in the graduating class among all the under-graduate programs of study, was given to three students this year: Shubhayu Chatterjee (MSc-5year/Physics), Ankit Kumar (BTech/CSE), and Ashish Gupta (BTech/CSE). The Director's Gold Medal was awarded to Tej Pratap (BTech/EE). Overall, more than 100 students received awards and medals during the convocation.

There is a nice tradition in IITK - the graduating under-graduate students elect the best teacher, and that faculty member is awarded the Gopal Das Bhandari Distinguished Teacher Award. This year, Dr. Swagato Kumar Ray of the Department of Mathematics and Statistics was honoured with this award.
New Appointments

**Prof. M. Anandakrishnan** has been re-appointed as Chairman of the Board of Governors. Prof. Anandakrishnan obtained his PhD in Civil Engineering from the University of Minnesota, USA. He was a faculty member in the Department of Civil Engineering at IIT Kanpur from 1963 - 1974. During this period he also served as the Head of Civil Engineering. His professional interests are in civil engineering, environmental engineering, remote sensing, information technologies, science and technology policy analysis, development indicators; he is also interested in the international transfer of technologies, small and medium industries, management of academic institutions and children's science education. Prof. Anandakrishnan received the Padma Shri in 2002 from the President of India.

**Prof. Avinash Singh** is the new head of the Department of Physics. He obtained his PhD from the University of Illinois at Urbana-Champaign, USA. His research interests are in correlated electrons and quantum magnetism, high-Tc superconductivity, metal-insulator transition, diluted magnetic semiconductors, metallic ferromagnetism and ferromagnetic alloys, spin-charge-orbital ordering in manganites and magnetic excitations in iron pnictides. Homepage: http://home.iitk.ac.in/~avinas/

**Prof. Munmun Jha** is the new head of the Department of Humanities and Social Sciences. He obtained his PhD from the University of Glasgow, USA. His research interests are in human rights issues, NGOs, social movements, caste and race. Homepage: http://home.iitk.ac.in/~mjha/

**Prof. Anish Upadhyaya**, Department of Material Science and Engineering is the new head of the Advanced Centre for Materials Science. He obtained his PhD from Penn State University, USA. His research interests are in materials processing, powder metallurgy, sintered particulate alloys and composites, microwave processing. Homepage: http://home.iitk.ac.in/~anish

Distinguished Lectures

**Petro Tel Distinguished Lecture in Chemical Engineering:** Dr. T. Ramasami, Secretary, DST, gave a lecture titled Combining Relevance with Excellence: A Scientist's Delight on 17th February, 2012. In his lecture Dr. T. Ramasami said that cultural dichotomies in the pursuit of excellence and the process of solving real-life problems of relevance through applications of science have remained generally un-bridged. Scientists seek to discover. Society seeks solutions to real-life challenges. Discovering solutions to real-life problems based on first principles in science represents a win-win formula for scientists as well as society. A travelogue of real-life experience in solving real-life problems through first principle derived science is planned. For instance, insight into the aqueous chemistry of chromium has led to the design and development of product and process innovations. Designs for environmental problems connected with chromium- based industries and the tannery sector were outlined. The delightful experiences of discovering solutions through applications of first principle science which have led to the saving of employment and the protection of the environment are to be shared. The emphasis of the talk was on connecting national relevance with global excellence for building inspirational leadership for Indian science.

**About the Donor:** The Petro-Tel Distinguished Lecture series in Chemical Engineering at IIT Kanpur has been made possible by an endowment from Dr. Anil K. Chopra (B. Tech/ChE/IITK/1976). Dr. Chopra obtained his PhD from the University of Houston, USA in 1982. Currently Dr. Chopra is the President, CEO and Chairman of Petro Tel Inc., USA.
Dr. M. A. Pai Distinguished Lecture: Prof. Bhim Singh, Department of Electrical Engineering, IIT Delhi gave a lecture titled *Power quality problems and their mitigation* on 26th March, 2012. Prof. Singh said that the electrical power distribution system suffers from problems such as a reactive power burden, unbalanced loading and harmonics. In his lecture he covered the major causes of such power quality problems and their solution in terms of custom power devices, power filters and improved power quality ac-dc converters (IPQC) in the distribution system. The custom power devices are classified into three categories: shunt connected compensators, series connected compensators and a hybrid of these two types of compensators. The power filters are classified as passive filters, active filters and hybrid filters. The power quality problems associated with conventional ac-dc converters can be resolved by replacing existing converters by improved power quality ac-dc converters. These converters are developed over the years and are available according to rating and suitability to applications. A comprehensive state-of-the-art on custom power devices, filters and IPQC configurations is targeted to cover the aspects of their control approaches, design considerations, selection criteria, potential applications, latest trends, future developments and comparative features.

About the Donor: Dr. M. A. Pai Distinguished Lecture Series in the Department of Electrical Engineering at IIT Kanpur has been made possible by an endowment from Professor Vijay Vittal (MT/EE/79), Harpole Professor, Department of Electrical and Computer Engineering, Iowa State University, Ames, USA. Professor M. A. Pai was a faculty member at IITK in the Department of Electrical Engineering from 1963-1976.

Institute Lectures

Dr. Mrinal K. Sen, Director, National Geophysical Research Institute, Hyderabad, and Jackson Chair Professor in Applied Seismology, The University of Texas at Austin, USA, gave a lecture titled *Subsurface Imaging: Challenges and Opportunities* on 9th April, 2012. In his lecture Dr. Sen said that earth science problem statements are easy to understand but difficult to solve. Citing the example of earthquakes he mentioned that earthquakes recorded on a worldwide network of seismometers are our primary source of data. Earthquakes typically occur at well-defined boundaries and seismometers are placed at sparse locations. Thus, many parts of the earth are devoid of ray paths. To address this issue, new passive experiments are being set up with large arrays of seismometers placed on the earth in a roll-along mode. Similar principles are being used in active seismic experiments for the detailed imaging of hydrocarbon reservoirs, the mapping of fluid flows for hydrocarbon production, the monitoring of subsurface CO2 movements and for earthquake hazard assessment. These problems can be best addressed by a multi-disciplinary approach.

Workshops and Conferences

National Workshop on Wide Area Monitoring and Control of Power Systems using Synchrophasor Technology was held from 13th – 14th April, 2012. Prof. Sanjay G. Dhande inaugurated the workshop. Prof. N. Murgesan, Director General, Central Power Research Institute (CPRI), Bangalore, was the chief guest. The workshop coordinators, Prof. Saikat Chakrabarti and Prof. S. C. Srivastava, Department of Electrical Engineering, said that the secure and reliable operation of modern power systems has become an increasingly challenging task due to the increasing demand of electricity. Wide area monitoring and control (WAMC) systems deploy phasor measurement units (PMUs) at selected locations in the transmission network. PMUs provide GPS synchronized time stamped...
voltage and current phasor measurements at a sub-second rate. The time-synchronized measurement system facilitates the use of several online systems to control the stability and security of power systems. The WAMC systems have already been installed in the electricity grids of several countries. There are plans to install the systems in the Indian regional power grid networks. The main objective of the workshop was to identify specific problems which need immediate focus to handle the challenges of wide area monitoring and control (WAMC). Academicians, officers/engineers from public energy/power utilities, corporate entities in the energy/power sector including equipment manufacturers and consultants, R&D organizations and regulatory commissions took part in the workshop.
Experts delivered lectures on specific issues and technological aspects of the wide area monitoring and control (WAMC) system, its architecture, various monitoring and real time control applications, experience and road map of deployment in the Indian grid and the testing requirements.
The workshop was supplemented by a lab demonstration of the WAMC technology using a real time digital simulator (RTDS) platform and a panel discussion.
For details visit: http://www.iitk.ac.in/wams2012/index.html

Obituary

Prof. Nadikerianda Belliappa Meena passed away on 3rd June, 2012. She was born on 5th February 1936 in Ammathi in Kodagu district of Karnataka. Prof. Belliappa obtained her PhD from Mysore University in 1969. Prof. Belliappa joined IIT Kanpur in 1986 and retired from service in 1996.

The Institute expresses its deepest condolences to the bereaved family of Prof. Belliappa and prays for the peace of the departed soul.

Support from Alumni and Friends

Ministry of Steel Scholarship: The Ministry of Steel has instituted 5 merit-cum-means scholarships. These scholarships are for academically bright students who agree to provide an undertaking to pursue their career in ferrous metallurgy.

Prof. Girdhar Gopal Shukla Memorial Scholarship: Mr. Ashish Shukla (MSc 5yrs/MTH/1997) has instituted a merit-cum-means scholarship for an Undergraduate / Postgraduate student in the Department of Mathematics and Statistics in memory of his father Prof. Girdhar Gopal Shukla who was a Reader in VSSD Law College, Kanpur. Mr. Ashish Shukla is currently working at Cadence Design System, San Jose, USA.

Smt. Neela Dutt Scholarship: Mr. Saibal Dutt (BT/EE/1977) has instituted a scholarship in the name of his mother Smt. Neela Dutt. The scholarship will be given to a student (preferably a girl student) in the Department of Electrical Engineering for academic excellence.

Steel Scholarship: Prof. B. Deo, Department of Material Science and Engineering has instituted two merit scholarships. The scholarships are for fourth year UG students doing a B.T.P in the area of iron and steel. In case no UG students are doing a B.T.P in iron and steel, then PG students doing thesis work in this area will be considered during the second year of their program.
Mr. Kaushal Dhar (MT/EE/75) has contributed US$ 500 through the IIT Kanpur Foundation as aid to the next of kin of Shri Rohit. Shri Rohit, aged 22 years, was an unskilled worker working at the construction site of the Single Bedroom Apartments (SBRA) as a helper to the mason. Shri Rohit met with an accident at the construction site and died in hospital on 18th May 2011. Shri Rohit, son of Shri Lal, was a resident of Bhaunti Village, Kanpur.

Achievements

**Research Fellowships to young faculty**

**Dr. Satyajit Banerjee**, Department of Physics, was selected for the P. K. Kelkar Young Faculty Research Fellowship. His research interests are in superconductivity and magneto-optics.

*Homepage: [http://home.iitk.ac.in/~satyajit/home.htm](http://home.iitk.ac.in/~satyajit/home.htm)*

**Dr. Saikat Chakrabarti**, Department of Electrical Engineering, was selected for the P. K. Kelkar Young Faculty Research Fellowship. His research interests are in power system dynamics and stability, state estimation, use of synchronised measurement technology in power systems and power system reliability.

*Homepage: [http://home.iitk.ac.in/~saikatc/](http://home.iitk.ac.in/~saikatc/)*

**Dr. Sudipta Dutta**, Department of Mathematics and Statistics, was selected for the P. K. Kelkar Young Faculty Research Fellowship. His research interests are in functional analysis.

*Homepage: [http://home.iitk.ac.in/~sudipta/](http://home.iitk.ac.in/~sudipta/)*

**Dr. Aditya K. Jagannatham**, Department of Electrical Engineering, was selected for the P. K. Kelkar Young Faculty Research Fellowship. His research interests are in wireless systems and networks, MIMO, LTE/OFDM, UMTS/CDMA, wireless sensor and ad hoc networks, digital and statistical signal processing for wireless PHY layer, wireless channel estimation, equalization and precoding, digital image/video coding and processing, H.264 and scalable video coding.

*Homepage: [http://home.iitk.ac.in/~adityaj/](http://home.iitk.ac.in/~adityaj/)*

**Dr. J. Ram Kumar**, Department of Mechanical Engineering, was selected for the Class of 1984 Young Faculty Research Fellowship. His research interests are in micro/nano-fabrication and finishing, nano composites and tribology.

*Homepage: [http://home.iitk.ac.in/~jrkumar/](http://home.iitk.ac.in/~jrkumar/)*

**Dr. Kallol Mondal**, Department of Material Science and Engineering, was selected for the P. K. Kelkar Young Faculty Research Fellowship. His research interests are in non-equilibrium processing, thermodynamics of glass formation and kinetic analysis for the devitrification of glass, deformation behavior of bulk metallic glass, corrosion and oxidation behavior of amorphous and nanocrystalline alloys, bulk metallic glass coating, tribology of bulk metallic glass and nanocrystalline alloys.

*Homepage: [http://home.iitk.ac.in/~kallol/](http://home.iitk.ac.in/~kallol/)*

**Dr. Nishanth Nair**, Department of Chemistry, was selected for the P. K. Kelkar Young Faculty Research Fellowship. His research interests are in chemical reactions in condensed matter systems by ab initio molecular dynamics simulation techniques.

*Homepage: [http://home.iitk.ac.in/~nnair/](http://home.iitk.ac.in/~nnair/)*
Domestic Solid Waste Management at IIT Kanpur

Early morning when all of us are busy preparing for the day's activity, a section of people with green masks on their faces are out there on the streets. Going door to door, collecting our domestic waste and dumping it into large bins placed at different locations in the campus. At this stage the A to Z organization, a leading provider of waste management services in Kanpur, steps in. It carries away the waste to its recycling plant and recycles it into useful manure. This entire process is a part of an elaborate waste management strategy adopted by the Institute. While the domestic waste is recycled outside the campus, green waste mainly comprising fallen leaves, takes two routes.

A large fraction of the green waste is handled through composting, a natural and cost-effective way of recycling organic matter. The process is indeed very simple and can be carried out on a wide range of scales in almost any indoor or outdoor environment. In the Institute, it is primarily done outdoors owing to availability of large open spaces. The dead leaves are dumped into deep rectangular pits created in the open and are loosely covered with soil. The filled pits are sprinkled with water and left for few months. During this time, the natural decay process breaks down the organic matter into rich humus like material. The final product is sieved and used as compost for gardens and flower beds.

Another method used for green waste treatment, though on a small scale, is vermicomposting. It is a simple biotechnological process where various species of worms, usually red wigglers, white worms and earthworms are used for decomposing green waste.

In the campus, the entire process is carried out within the confines of a Vermicompost Plant in the nursery. The unit has two storage pits on the left, six bins on the right and two large pits in the centre. Vermicomposting is a multi-step and closely monitored process. The stacked leaves are dumped into a bin and left for drying. After a week, the dried heap is shifted to the adjacent bin and sprinkled with water. Water helps in reducing the volume of leaves. The following week, the heap is shifted to the third bin where a small amount of cow dung is added to it. This stage lasts for about two weeks.

By the time the process enters its fifth week, the texture of the leaves has changed considerably. Now is the time for worm activity. The two large pits in the centre of the vermicompost unit are used for worm action. Each pit can accommodate four vermibeds at a time.

A banana leaf serves as the base of the vermibed. A layer of 3-4 inches of the organic mixture is spread out on the leaf and earthworms are added over it. Earthworms are also known as composting worms as they are very efficient processors of organic material. The whole process is repeated till a pile of 1-1.5ft is created. The pile is topped with
cowdung and left undisturbed for a month depending on the weather conditions. During this time, the earthworms digest the organic material and turn it into vermi-compost. The finished product is dark and crumbly with an earthy odor. After sieving, it is used as manure for surrounding areas. This manure has been tested for its high nitrogen content in the Institute’s laboratory.

By using the most eco-friendly alternatives to leaf burning the Institute has gained the status of a 'Zero Burn campus'.

The entire process of waste management can be viewed in the link below:
http://www.youtube.com/watch?v=d1U9o7avdeU

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Student Initiatives

A project on bipedal robot by Aditya Prasad (BTech/MSE), Ashutosh Sharma (BTech/MSE), Vikalp Verma (BTech/ChE) and Akshansh Singh (M.Sc/PHY)

The aim of this project was to build a manually controlled simplified version of a bipedal robot. The term “biped” means “two feet”. As the name specifies, a bipedal robot is designed to imitate the motion of a human being, i.e., it can walk on two legs without any external support for balancing.

The bipedal robot that these students have made has two degrees of freedom per leg as compared to three degrees of freedom per leg in an actual bipedal robot. Due to this the motion of the bot is limited in the vertical direction, i.e., it cannot bend on its knees, but the bot can still perform the basic actions of movement and turning.

Bipedal: An Overview: As compared to the usual wheel based robots, the bipedal bot is designed to imitate the complex walking mechanism of a human being. Balancing is the main aspect of producing a “stand-and-walk-on-two-legs” phenomenon. With proper balancing, a bipedal becomes much more versatile as compared to the usual wheel based bot because of the fact that the base level of a bipedal is not fixed, thereby enabling the bot to raise itself on a higher terrain just by a simple motion of the knee joint. On the negative side, a bipedal bot loses the speed advantage as compared to a usual bot due to the lack of wheels. Although a bipedal bot that can run is a possibility for higher speeds, the balancing of such bots is much more difficult and usually requires complex programming involving gyroscopes, accelerometers, etc.

For the sake of simplicity, the students had restricted the degrees of freedom of their bipedal bot to two (per leg). Their bipedal had the hip joint and the ankle joint but lacked the knee joint. This setup allowed the bot to perform the following set of motions for each leg:

1. Rotation about the hip joint with an axis passing vertically along the body of the bot.
2. Rotation about the ankle joint with an axis perpendicular to the length of the bot and going into the plane of the bot.

This kind of setup allowed the bot to move through a “lean-and-turn” mechanism, i.e., the bot leaned on one leg through the ankle joint and then rotated the other half of the body in a forward direction. This sequence is one half of a step which is symmetrically repeated by the other leg to complete one step of forward motion of the bot.

Watch it in action: http://www.youtube.com/watch?v=hdOxSISoV3o
A project on Magbot – climbing up the wall by Ayush Varshney (BTech/EE), Raghav Gupta (BTech/EE) and Govind Saria(BTech/EE)

Magbot - climbing up the wall is essentially a mechanical project designed to climb up any wall made of a magnetic material. Based on a zigzag pattern of magnets placed on two independently driven nylon wheels, the bot can move as freely on vertical surfaces as on the ground.

The students were fascinated by the way a lizard crawls up the walls and is able to maneuver all around the room. They tried to imitate the same and came up with this Magbot – A Magnetic Wall Climber. This robot is an example of Biomorphic Robotics in which they try to imitate a natural creature with all its features and specializations. Their bot is designed to climb up any magnetic wall and take all possible turns in all directions.

The most integral part of the design are the two Nylon based wheels consisting of a zigzag pattern of magnets placed on their rim. The magnets are placed in such a way that as one magnet loses contact with the wall, the next comes in to take its place. The magnets (made from Neodymium) are very strong, two of these at a time can support the entire weight of the bot. A metallic shell has been used to keep the magnets in place and to allow the wheels to roll smoothly on the walls.

The wheels are driven by two high-torque motors, which are needed to pull the magnets out from the wall. Another very innovative feature of the design is the flexible magnetic tail. The tail is designed specifically for allowing the bot to take any possible turn, specifically the 90-degree turns, and also supports it while it is climbing up. It has been made using hinges and magnetized castor wheels.

The students hope to improve this design to implement vertical line following or image processing in the bot.

Watch it in action: http://www.youtube.com/watch?v=9Cy0STnPgjY