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Newsletter of Foundation for Innovation and Technology Transfer, Indian Institute of Technology, Delhi

The Golden Jubilee Logo consists of four parts, namely a timeline *foundation*, the *iconic roof of the Dogra Hall, a pair of crystal wings* and the *rising arc of organic knowledge.*

CONTENTS

The Golden Jubilee Year

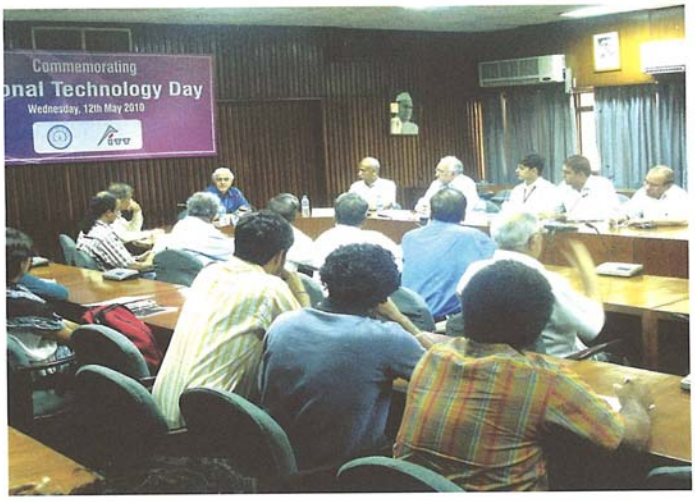
"Waka Waka...." The just concluded 2010 FIFA World Cup defied the "Pundits" and "Punters"; went along with *Paul* – the octopus's predictions, threw up surprises but, did not fail to show up rugged determination, enthusiasm and all-around passion in the scintillating game of soccer. It was a rolling event. The same passion and enthusiasm has played out at IIT Delhi for the past 49 years ! Yes, we are entering the Golden Jubilee Year from August'10. And this is only a milestone in our long and high-standards' journey of academic pursuits. Fortunately, the journey has not been solo or isolationist. It has been an over-arching evolution that, in its wake, has created an ecosystem of excellence in learning and development. Amongst its various program manifestations has been the creation of Foundation for Innovation and Technology Transfer (FITT) – an organisation meant to strengthen the Institute's outreach to business and the community through its various activities and programs drawing on the intellectual and infrastructural strengths of IIT Delhi. We invite you to join us in our endeavour towards still higher accomplishments for the Institute which has just unveiled it's beautiful Golden Jubilee Logo as seen on the cover page.

The financial year end 2010 for FITT was yet another period of growth and consolidation. The numbers were better off than in the previous years, contributed in part by our increased attention towards International projects that involve a consortium approach to research and development. However, as always, we bet on relating with the business towards knowledge transfer. We believe this is an effective mechanism for technological intervention. The increased thrust towards professional development programs primarily aimed at the industry segment continues. Technology commercialization through licensing and techno-entrepreneurship particularly through the incubation route continue to be our flagship verticals. These programs have also acquired wider dimensions of leveraging the various open innovation platforms supported by the Government entities eg DIT, DSIR, MSME and TIFAC. Three of our promising TBIU start-ups exited for scale-up and regular commercial operations. We are on the track of strengthening our techno-entrepreneurship program at IIT Delhi and trying to come up to the potential and expectations. Our hard work continues !

Anil Wali

National Technology Day

FITT organised the celebration of the National Technology Day at IIT Delhi on May 12, 2010. On this occasion, a thematic seminar "Incubating Technology Solutions" was held at the Senate Room of the Institute. The speakers on the occasion comprised of Prof. KR Rajagopal (Dept. Electrical Engg., IIT Delhi and promoter of TBIU Start-up Global Motor Tech Pvt Ltd), Dr. Aaditeshwar Seth (Deptt. Computer Science & Engg and promoter of TBIU Start-up Gram Vaani Community Media Pvt. Ltd.), Shri. Ravi Kapoor (Promoter : Faros Technologies Pvt. Ltd) and Sh. Dipinder Sekhon (of Kritikal Solutions Pvt. Ltd). The programme was inaugurated by Prof S Prasad, Director, IIT Delhi and was attended by several senior faculty members, students and some members of the industry. The four presentations during the seminar highlighted the respective backgrounds, development challenges, strategies and successes in technology venturing at the TBIU in IIT Delhi.



FITT extends following supports under approved Government Schemes

Entrepreneurial and Managerial Development (MSME) - *to nurture / promote technology / knowledge - based innovative ventures through* financial / incubation support (www.msme.gov.in)

Innovation Support – under TePP (DSIR) - *to enable innovators to become technology entrepreneurs through* financial support / mentoring – *upto Rs 15 / 45 lakh* (www.dsir.org)

11 GHz UGBW OPAMP with Feed-Forward Compensation Technique

Hitesh Shrimali, Shouri Chatterjee

Abstract—A high speed pseudo differential three stage operational amplifier has been implemented using a feed-forward compensation technique in a standard 0.13 m CMOS technology. The three stage inverter based opamp with feed-forward compensation achieves 11 GHz of unity gain bandwidth and exhibits 39.5 dB of DC gain with phase margin of 62 when driving a differential load of (2300 fF). The proposed opamp achieves a figure of merit (FOM) of 440 [1] and in simulation, the overall circuit consumes 18 mw of power.

1. Introduction

An operational amplifier is a key building block in analog circuit design. For maximum bandwidth, minimum length devices offer the maximum advantages as these have maximum fT . A typical 0.13 m CMOS device has an intrinsic gm rds of 8 for minimum channel length because of short channel effects. This limits the maximum gain of a typical two stage opamp design to less than 36 dB. This is unacceptable for high performance designs. One can opt to use a cross-coupled pair to improve the gain, however this kind of gain enhancement is uncontrolled. One can use a folded cascode amplifier to achieve higher gain; however, this limits the output swing of the first stage of the amplifier and creates difficulties in biasing at low power supply voltages.

A traditional three stage amplifier achieves higher gain than a two stage amplifier, but has limited bandwidth. Different frequency compensation techniques have been reported for three stage operational amplifiers. In the proposed design, a feed-forward compensation technique [2] has been utilized to stabilize a three stage operational amplier without sacricing bandwidth.

2. Design

Fig. 1 shows the block-diagram of a three stage operational amplifier with feed-forward compensation. For easy analysis, a single ended design is shown. A feed-forward compensation technique has been used to stabilize the three stage operational amplifier. The three stage cascaded amplifier on path A provides a gain of ÀÛÜA3 V at low frequency. At high frequencies, since path B is faster, the amplifier will typically have a gain of only ÀÛÜAVf. At the same time, to first order, the gain bandwidth product will be given by AV f times the bandwidth of path B. A class AB based push pull amplifier has been used to implement each of the single stage amplifiers.

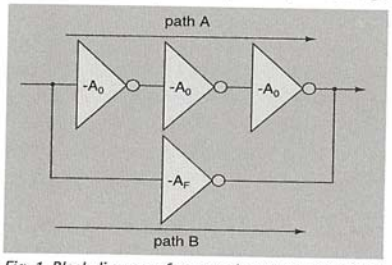


Fig. 1. Block diagram of proposed 3-stage operational amplifier with feedforward compensation

Fig. 2 shows the transistor level implementation of the pseudo differential operational amplifier. The cascaded stages on path A are made identical. The aspect ratio of the forward path transistors have been chosen such that the desired phase margin is obtained.

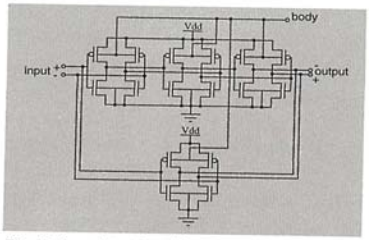


Fig. 2. Transistor level implementation

The three stage operational amplifier with pseudo differential topology gives a common mode gain which is the same as the differential gain. The common-mode gain is negative. As a result, when the opamp is used under negative feedback conditions, the common-mode voltage will automatically stabilize and no additional common-mode feedback loop is necessary. A small-signal low frequency voltage gain of the three stage operational amplifier is shown in equation 1

$$AV = ÀÛÜ\ GmR(+ G2mR2)1 + (1)$$

where Gm = gmn + gmp, R = rdsnjjrdsp and is defined as the ratio of an aspect ratio of the path A to the path B. The feed-forward path adds a pair of complex and conjugate zeros in the amplifier transfer function in order to stabilize the 3-stage operational amplifier.

3. Simulation Results

Fig. 3 shows the magnitude and phase plot of an operational amplifier. The magnitude plot shows 39 dB of gain with11 GHz unity gain bandwidth and the phase plot shows a phase margin of 62 when driving a differential load capacitance of 300 fF. The gain

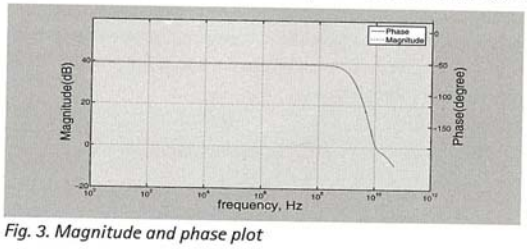


Fig. 3. Magnitude and phase plot

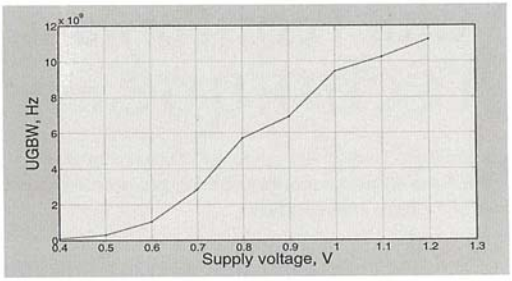


Fig. 4. Unity gain bandwidth as a function of supply voltage

plot clearly shows a double pole at the same frequency. The compensated pole and zeros plays a vital role to tune the phase margin.

Fig. 4 shows the variation of unity gain bandwidth with respect to supply voltage. Even at extremely low power supply voltages (0.4, 0.5 Volts), the opamp is usable at significantly large frequencies. This is because of the design strategy - not using any cascode stages or even a tail current source. The opamp primarily uses the CMOS inverter as its building block. We have taken advantage of the robustness and simplicity of the CMOS inverter. Fig. 5 shows the power consumption of an operation amplifier with respect to supply voltage.

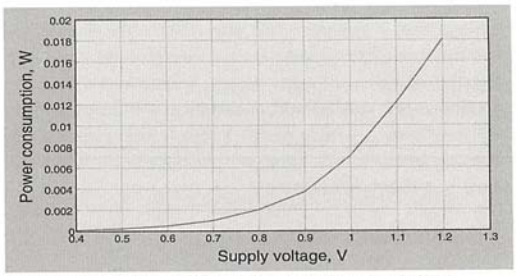


Fig. 5. Power consumption as a function of supply voltage

4. Conclusion

A feed-forward compensation has been implemented by keeping a single stage differential amplifier in the feed forward path in order to achieve a very high speed and stability. The use of a class AB push pull inverter gives very high bandwidth and swing. One can design extremely high speed analog systems, such as continuous time sigma delta (CTSD), filters using such an opamp.

This opamp has been designed at the VLSI laboratory, IIT Delhi. It has been incorporated into the design of a high speed continuous time sigma-delta analog-todigital converter. The design has been sent for fabrication and test results are awaited. For more details, contact shouri@ee.iitd.ac.in.

References

[1] W.M.Sansen, Analog Digital Essential. Springer-verlag, 2006, no. ISBN978-0-387-25746-4.

[2] L. Li, "High gain low power operational amplifier design and compensation technique," Ph.D. dissertation, Brighom Young University, April 2007.

Holographic Devices Information

The principle of holography, as conceived by Dennis Gabor in 1947, for which he received the Nobel prize, involves the recording and reconstruction of complex interferograms. As compared to photography, holography is a non-conventional imaging technique without even the need of lenses for imaging, at the same time, renders 3-dimensional views from its images. Some of the unique characteristics of holography make it a very powerful and useful tool with potential applications in many areas. Some of these practical application areas include, information security, information storage and search, pattern recognition, non-destructive testing, advertising, medical imaging, display technology, futuristic photonic circuits etc. Our research group has been involved in developing novel techniques and architectures towards some of the contemporary holographic applications that include high density data storage, holographic search engine, holographic lithography for photonic structure fabrication, optical pattern recognition, digital holographic microscope etc.

High Density Holographic Data Storage: A digital holographic disk (DHD), employing holographic principles for the storage and retrieval of huge amounts of data at fast parallel transfer rates, is envisaged as the next generation removable storage device after DVD and Blue Ray-DVD. Holographic data storage offers storage capacities of the order of many Terabytes on a disk. A holographic storage disk can support a transfer rates in Gb per second in comparison to current technology's few Mb per second. These features have been achieved by the page-oriented storage principle and the multiplexing of a large number of such data pages in a single location. In spite of active research carried out over the last few decades by various research groups around the world in the topic of holographic data storage systems, there are many issues which need further improvement. We have made significant contributions in increasing the memory capacity, improved bit-error rate characteristics and better content search capability of defocused volume holographic data storage systems that use photopolymer as the recording medium.

Holographic Image/Data Search Engine: In addition to conventional address-based read-out, DHD offers the potential for simultaneous search of an entire database by performing multiple optical correlations between the stored data pages and a search argument. Such an added feature of content-addressable searching is always beneficial considering the high storage density of 500 Gbytes in 120 mm disk with VHDS. Since a holographic search engine performs an entire database search with a single optical exposure, it can potentially search massive databases orders of magnitude faster than conventional

for Technology

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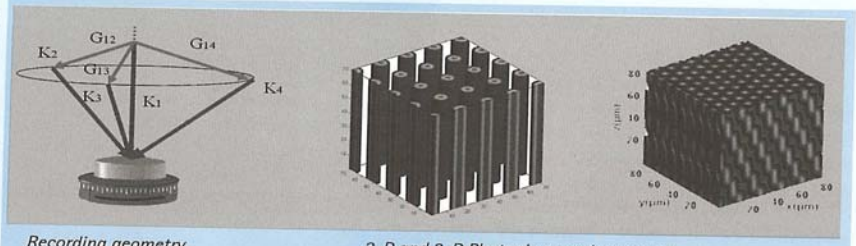
alternatives. The degree of similarity between a stored data page or image in the data bank and the search argument is measured by the intensity of the diffracted light that corresponds to the correlation peak, which is the inner product between the stored data page and the search page.

The identification of gray-scale images with distortions like rotation, scale, and noise, etc. is a challenging task in pattern recognition applications. For distortion-invariant pattern recognition, either a data bank comprising large number of distorted versions of images is generated or distortion-invariant filters are designed to cater to the invariance. There have been numerous studies on volume holographic correlators for pattern recognition applications. One of the limiting aspects of gray-scale images when used in holographic correlator is the fact that they always produce strong dc and low frequency components and hence produces unwanted correlations when a multiplexed holographic correlator is used for pattern recognition purposes. We have introduced novel image coding techniques that significantly improved the correlation accuracy of holographic search systems. We have also designed and implemented improved content addressable search methods, such as two-dimensional data encoding employing phase-based data pages, gray-scale & sparse-gray-scale data pages etc. for use in defocused volume holographic search systems.



Recording geometry *2-D and 3-D Photonic crystal structures*

Fig. 1: Holographic lithographic geometry and photonic structures

Holographic Lithography for Photonic Structure Fabrication: Another recent application of holography is, to use it as a tool to fabricate large area nano-photonic structures. Nano-photonics promises captivating new fundamental physics, and new applications in low power, ultra-small devices performing at the quantum edge in a wide range of technologies such as information processing, telecommunications, medicine and biotechnologies. Holographic technique has great potential in forming 2-D as well as 3-D volumetric structures in photosensitive materials. Photonic crystal structure requires a high contrast volumetric pattern. In holographic lithography, a periodic intensity distribution is produced with the help of 2 or more collimated beams [Fig. 1]. A photosensitive material such as photoresist or photopolymer is exposed to that intensity distribution. Post-exposure processing imposes a threshold on the smoothly-varying intensity contours in the interference pattern. Usually, photoresist is used as a recording material and after development the recorded structure is transferred to a high refractive index material, such as Silicon. Even though, the fabrication of photonic structures on relevant length scales (i.e., nanometer, sub micrometer, and micrometer) can be achieved by means of various techniques such as electron or ion beam writing, deposition methods and self assembly, the prime advantage of holographic lithography is, to fabricate large area defect-free nano-photonic structures both rapidly and cheaply.

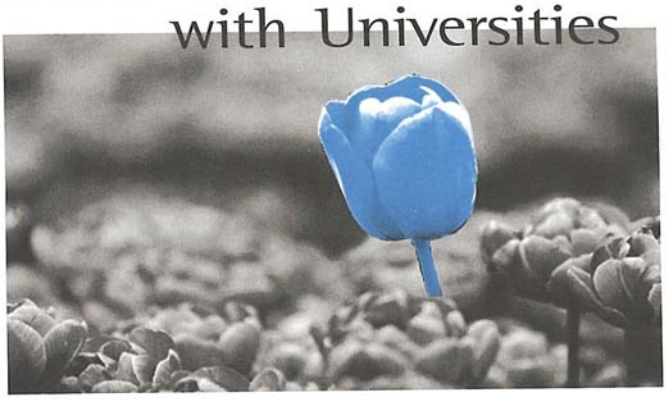
We have developed novel methods based on two-beam and multiple beam interference having potential to realize any of the crystal lattice structures including diamond structures, based on designs which are least complex and provide more flexibility compared to existing techniques. We have shown that, by the interference of multiple beams as well as by the multiple exposure of two beam interference, all fourteen 3D Bravais lattices can be generated. Based on the approach, high quality 3D holographic templates belonging to the desired lattice structure can be fabricated with a simplified experimental set up.

Digital Holography: Compared to conventional holography, digital holography involves recording of holograms on a CCD/CMOS camera instead of a photographic recording medium, which renders an important addition degree of freedom, namely the computational degree of freedom. Hologram is reconstructed through computational algorithms, allowing the incorporation of digital processing tools to extract object information in totality i.e, both amplitude and phase information. We have developed many techniques for digital holographic object reconstruction for improvement in terms of object resolution, speed of reconstruction, recognition and classification of 3-D amplitude and phase objects, wavelet processing of object information, opto-electronic 3-D correlation, 3-D microscopy etc.

More information and details on these research findings can be learned from the list of publications and the reference there in, available at http://web.iitd.ac.in/physics/fac/jj.htm

From Science to Business: How Firms Create Value by Partnering with Universities

Source
Prof Georges Haour, 2010



In today's "knowledge-based" society, it is becoming increasingly imperative for companies to "mine" the new knowledge and technology generated by universities. Why? Because the knowledge and technology transfer that result from industry-university collaborations can be used by companies to accelerate innovation and deliver business impact.

There are various ways that companies can tap into the new knowledge and technology generated by universities – from hiring graduates to commissioning contract research.....

Partnerships between companies and universities are particularly critical as we face mounting issues around energy, water, food and climate. Never before have non-business issues been so relevant to business. Industry and academia must team up to move our world towards a more sustainable future. Only China, Germany and Japan have made substantial commitments in this area. And never before have non-technical innovations been so critical to business success – innovations such as novel business models or managerial practices that are often enabled by information and communication technologies.

The Changing Landscape for Universities and Industry

Universities worldwide are confronted with diminishing growth in public funding (e.g. Japan is decreasing by 1% per year), and they are being forced to adapt by raising funds from private sources. But, as the above figures indicate, they probably can't count on a commercialization bonanza in the foreseeable future. However, they must take steps to make the difficult transition by changing their academic mindsets and moving towards becoming more firm friendly and solutions-oriented.

But it's not just universities; industry is also changing at a fast pace. With increasingpressure to focus internal R&D activities on short-term payoffs, many companies are beginning to pursue their long-term strategies through collaborations with universities. As a result, new partnerships are emerging that will ultimately change the roles of both.

India's Labs Waking Up, Surge in Global Science Papers

Source
Indian Express 11.1.2010

Often referred to as a "sleeping giant" in scientific literature, India seems to be waking out of its slumber, says a recent global research report on "Research and Collaboration in the new Geography of Science" by Thomson Reuters.

If the current trajectory continues, the study estimates, India's productivity would well be on par with that of most G-8 nations within eight years and could even overtake them between 2015 2020.....

Between 1993-2003 and 2004-08:

- In Chemistry, India's research output increased from 21,206 world publications to 33,504
- From a 2.8 per cent share of the world output in pharmacology and toxicology, India's share is up to 4.25 per cent
- Output in engineering rose from 2.69 per cent to 3.57 per cent
- Microbiology saw publication output rise from 1.62 per cent to 2.79 per cent

Agricultural engineering, Tropical Medicine, Organic Chemistry and Dairy & Animal Science are areas of research where India is picking up well besides Crystallography and Textiles.....

India's Innovation Problems

Source
Mint 13.12.09

A recent *New York Times* (*NYT*) story raised an interesting question. Why has India not produced a Google or an Apple? The question can be reframed broadly: Why is India a laggard when it comes to innovation?

There is probably no single answer. The stifling environment for the first four decades after Independence (others will say the problem dates back to ancient India), lack of funding opportunities for innovators and easy availability of off-the-shelf technologies are some of the contributing factors. Each of them is a story in itself.

Today, there is no shortage of innovators who want to create new products. *NYT* noted the case of Sloka Telecom in Bangalore. The company is developing a new range of radio systems that are less expensive than those used by companies today. One could say the future belongs to such innovations. Yet, companies such as Sloka Telecom have difficulty in finding venture capital funding.

One reason for this problem could be the absence of deep financial markets that permit funnelling of money into risky ventures. This is to be distinguished from risk-taking. After all, Indian investors are hardly risk-averse when it comes to equity market investments. The problem here is that of time horizons of investors. Investing in a risky product is very different from investing in a risky stock. Liquid financial markets can make a difference here.

This is one end of the Indian innovation problem. The other side is probably more complicated. Why have Indian companies preferred to buy ready-made technologies instead of producing them at home? For the first 40 years after Independence, India was a closed economy, one that did not have to export goods for its survival. The result was that returns from scientific research, which yields innovative products, were much lower than outright purchase of technology. Lack of export markets virtually killed innovation at home. In all other "late industrializing" economies such as South Korea and Taiwan, innovation was the driver of growth. India never took that road.

Now, of course, the bitter fruits of that past are ripe. Companies such as Sloka Telecom worry where the money will come from while export markets will require a repertoire of innovations that India does not have, for the moment. For India, the time is short and the road to innovative products long.

Science is for people

Source
Business Standard 22.6.10

Latha Jishnu in conversation with Richard Jefferson, one of the world's top technologists

Indian scientists must eschew their tribalism and absolutism and should learn to be more aware and inclusive to create the right products and services for society.....

Distinguished Fa

Prof. Bodh Raj Mehta is currently a Professor in Department of Physics at Indian Institute of Technology Delhi, New Delhi, India. He received M.Sc. (Physics) degree from Punjabi University Patiala, Punjab in 1977 and M. Tech in Solid State Materials from IIT Delhi in 1979. He received PhD degree in Physics in the area of thin film photovoltaic devices from IIT Delhi, did his post doctoral studies at University of British Columbia, Vancouver, Canada and subsequently joined Department of Physics at IIT Delhi in 1985.

Prof. Bodh Raj Mehta

Prof. Mehta has worked on a number of important research issues related to science and technology of thin film and nanostructured materials. One of his important research contributions has been the conceptualization of the usage of nanoparticle characteristics for solving some of the nagging material problems inhibiting the performance of switchable mirror devices. The novelty of using 'nanoparticle route' lies in realizing the improvements without altering the physics and chemistry of the Rare Earth-Hydrogen interaction. This path breaking work has resulted in the development of a 'new generation' of nanoparticle based switchable mirror devices. Blue shift in optical absorption edge, enhanced surface area at nanodimensions resulted in improved colour neutrality, improved optical contrast, faster response time and enhanced hydrogen catalytic activity mediated by surface states. A unique core-shell structure has been used to stabilize Rare Earth nanoparticle against oxidation while allowing two-way hydrogenation through the protective oxide layer. These results have wide ranging importance in the research areas related to hydrogen storage and sensing.

His research on the study of Pd nanoparticle involving in-situ investigations of hydrogen induced changes in the current transport mechanism and structural modifications has given fresh insights into one of the most important (due to its direct relevance in a number of advance technologies) and probably the most complicated (from physics and chemistry point of view) solid-gas molecule interaction. The novelty of his research approach has been to separate the interfering effects of hydrogen induced topographical, structural and electronic changes by a precise control of nanoparticle size and interparticle separation. Based on the improved understanding of the gas- solid interaction, this study resulted in a 'proof of concept' for developing a new type of hydrogen and deuterium sensor having a pulsed

Prof. M. Jagadesh Kumar was born in Mamidala, Andhra Pradesh, India. He received the M.S. and Ph.D. degrees in electrical engineering from the Indian Institute of Technology (IIT), Madras, India. From 1991 to 1994, he performed postdoctoral research in the modeling and processing of high-speed bipolar transistors with the Department of Electrical and Computer Engineering, University of Waterloo, Waterloo, ON, Canada, where he also did research on amorphous silicon TFTs. From July 1994 to December 1995, he was initially with the Department of Electronics and Electrical Communication Engineering, IIT, Kharagpur, India, and then, he joined the Department of Electrical Engineering, IIT, Delhi, India, where he became an Associate Professor in July 1997 and has been a Full Professor since January 2005. He is currently the NXP (Philips) Chair Professor established at IIT Delhi by Philips Semiconductors, Netherlands (now NXP Semiconductors India Pvt Ltd). His research interests include nanoelectronic devices, device modeling and simulation for nanoscale applications, integrated-circuit technology, and power semiconductor devices. He has published extensively in these areas of research with three book chapters and more than 145 publications in refereed journals and conferences.

Prof. M. Jagadesh Kumar

Prof. Jagadesh Kumar made significant contributions to innovative semiconductor device design and modeling for (i) Nanoscale CMOS technology and (ii) high-speed switching applications. His work led to novel designs and improved understanding of high-speed lateral bipolar transistors, Nanoscale MOSFETs, Polysilicon Thinfilm Transistors and high-voltage Schottky rectifiers. Prof. Kumar's work has been extensively cited in international journals and books.

Schottky rectifiers are extensively used in high speed switching applications. However, they suffer from large reverse leakage current and soft breakdown. For the first time, Prof. Kumar has shown that using a dual Schottky contact in a lateral device, the breakdown voltage of Schottky rectifiers can be made very sharp in addition to achieving a low forward drop and negligible reverse leakage current. His other important invention is making an Ohmic contact conduct only in one direction. This rectifier is named as Shielded Ohmic Contact (ShOC) rectifier which exhibits very low forward voltage drop and also low leakage current.

He has recently invented a new mechanism for increasing the current gain of bipolar transistors. These two technologies are the backbone of the VLSI chip manufacturing. Prof. Kumar has shown that in the proposed structure, known as the Surface Accumulation Layer Transistor (SALTran), the current gain is enhanced using a physical mechanism not visualized so far. The SALTran exhibits a

culty of IIT Delhi

response with fast response of the electronic effect and high sensitivity of the topgraphical effect. The results of the above investigations have been published in high impact factor journals like Advanced Materials, Advanced Functional Materials, Applied Physics Letters, Physics Review and Nanotechnology.

Prof. Mehta has carried out research on the basic issues related to the effect of nanoparticle size on the structural transformation in oxide nanoparticle systems. His research has led to the observation of an important effect of "size-dependent conductivity-type inversion" in single-phase copper oxide nanoparticles. At present his research group is involved in understanding the mechanisms of filamentary growth and charge migration in oxide nanorod structures for resistive memory devices. This activity is aimed at developing single nanorod based memory devices. His present research activities are planned towards understanding the structural and electronic nature of the interface between two dissimilar materials like organic-inorganic bilayers, junctions between carbon structures and semiconductor layers, nanostructures - bulk interfaces, semiconductor – self assembled monolayer assemblies. The outcome of these research efforts are expected to have important implication towards improving the performance of resistive memory, thin film transistor, photovoltaic and light emitting devices.

His research career started under the inspiring and able guidance of Prof K.L. Chopra from whom he learnt the art of combining basic science issues with technological applications and this had made a lasting impact on his research methodology. The above mentioned research has been made possible by the hard work of about 15 PhD and about 60 MTech, MSc and BTech students under his supervision. His research has resulted in about 125 publications in international peer review journals and more than 100 presentations in national and international conferences. Prof Mehta has organized a number of important national and international conferences including International Conference on Nanoscience and Technology (ICONSAT 2006), a flagship activity of Nano Mission Programme. He has been inspired by the exceptionally brilliant scientific leadership of Prof. C.N.R Rao and thoroughly enjoyed interacting with Prof.Rao during the organization of ICONSAT 2006 and other Nano Science and Technology activities. He has participated in a number of programmes for popularizing science and has also given expert commentary in 13 episodes of a popular science TV serial *'Nano Duniya'*

Continued on page 10

current gain similar to that of a SiGe HBT. He has shown that the using a combination of SALTran concept and SiGe base, bipolar transistors with current gains exceeding 10,000 can be realized – a significant result in the area of bipolar transistors.

A recent invention by Prof. Kumar is in the area of Polysilicon TFTs with three orders of magnitude less leakage current. He has shown that using his multi-gate concept, the pseudo-subthreshold conduction observed in conventional TFTs can be completely eliminated leading to a substantial reduction in OFF state leakage current without affecting the ON state current. Since these devices are very commonly used in active matrix LCD displays, a low leakage polysilicon TFT will have a significant commercial utility. For the first time, Prof. Kumar has proposed a Schottky collector bipolar transistor with a collector breakdown as large as 30 V which was thought to be not possible earlier. This invention is expected to widen the high speed applications of BJTs.

In addition, Prof. Kumar has made many theoretical contributions in Nanoelectronics as evidenced by his publications.

Prof. Kumar has also made significant contributions to the development of compact models required in circuit simulation applications. His model for the base transport time of SiGe HBTs is widely used and considered an important work. He has also developed a unified threshold voltage model and IV model for the dual-material gate Nanoscale MOSFETs. For the first time, he also developed a simple analytical model for the strained silicon Nanoscale MOSFETs which are considered to be the future of CMOS technology. His recent work includes introducing innovative device design in Tunnel Field Effect Transistors for future CMOS applications to meet the ITRS guidelines in terms of ON current and a pragmatic threshold voltage and designing LDMOSFETs for wireless base station applications.

The inventions made by him are applied in nature and have a large potential for commercial exploitation. The work done by Prof. Kumar, therefore, has led to filing five patent applications by IIT Delhi. Prof. Kumar has carried out four sponsored projects two of them involving defense. In the first project, Prof. Kumar has demonstrated India's first High voltage SiC Schottky rectifier with a breakdown voltage of 1000 V. In the second project, he has designed a 40 GHz High Electron Mobility Transistor which was then fabricated by Solid-state physics laboratory, Delhi.

Prof. Kumar has played a prominent role in bringing together researchers working in Nanotechnology area at IIT Delhi. The nanotechnology group, of which he is a principal lead investigator along with two other colleagues, is currently working on building a state-of-the-art nanotechnology center focusing on non-silicon based devices and applications. This is a highly interdisciplinary effort with deliverables

Continued on page 10

Continued profile of Dr. Bodh Raj Mehta

broadcasted by Doordarshan.

Prof. Mehta has completed a joint research project with *Nanostrukturtechnik* Group at University of Duisburg-Essen, Germany. Under this project, a novel integrated approach has been used for the synthesis of size selected, monosized, monocrystalline and spherical nanoparticles and nanoparticle-thin film composite structures having controlled configuration. This well controlled and precise fabrication methodology has been used for realizing 'nano' effects in a number of devices. On the basis of 'scientific excellence', Director General of Research, European Commission has selected this project as a success story of project and an article on the achievements of this project is included in a book of 75 success story projects: 'Marie Curie Actions - Inspiring Researchers'.

At IIT Delhi Prof. Mehta has been responsible for initiating a number of group research activities at IIT Delhi. He has coordinated the establishment of a state of the art Unit on Nanoscience at IIT Delhi. He also initiated the establishment of Focussed Ion Beam and Field Emission Scanning Electron Microscopy Facility as a joint facility between Unit on Nanoscience and Department of Mechanical Engineering. He is the co-coordinator of IIT Delhi and Lockheed Martin research collaboration in the area of Bio-Nano and Nanotechnology. He is Principal Investigator and Coordinator (India) of 'EU-Indo Forum on Nanomaterials for Energy' in which 6 institutes from India and 7 institutes from Europe are participating. He is an active participant of the tri-national collaboration on Nanotechnology under IBSA (India, Brazil and South Africa) Initiative and is the Project Coordinator (India) of 'Advanced Materials for Energy' of the IBSA programme. As a principal investigator he has successfully completed a large number of research projects from Indian and international funding agencies. He has participated in a number of successful collaborations with researchers from Indira Gandhi Center for Atomic Research, Kalpakkam, National Physical Laboratory, Delhi and Inter University Accelerator Centre, Delhi,

In recognition to his contributions in the area of science and technology of thin film and nanostructured materials, Prof. Mehta has received DAAD fellowship of German Academic Exchange Programme, Medal of Materials Research Society of India and Marie Curie International Research Fellowship of European Commission. He is on the editorial board of Journal of Nanoscience and Nanotechnology and Journal of Nano Education. He is the member of Programme Advisory Committee (Condensed Matter Physics and Material Science) and Member of the PAC on Physics, Astrophysics and Lasers of the International Division of DST. He is a member of the National Committee on Standardization for Nanotechnology, Bureau of Indian Standards, New Delhi and a member of the Interdisciplinary Research and Selection Committee of CSIR.

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Continued profile of Prof. M. Jagadesh Kumar

ranging from Organic based thinfilm devices to fuel cells.

Prof. Kumar is also the lead principal coordinator of Center for excellence in nanoscale devices, circuits and systems. He is also the coordinator of VLSI Design Tools and Technology program which runs a completely industry sponsored M.Tech program and research programs related to industry applications

Dr. Kumar is widely recognized for his work and has received several recognitions. He is a Fellow of the Indian National Academy of Engineering and the Institution of Electronics and Telecommunication Engineers (IETE), India. He is an IEEE Distinguished Lecturer of the Electron Devices Society and has given popular lectures to large audiences on topics related to Nanoelectroncs and Nanotechnology. He is a member of the EDS Publications Committee and the EDS Educational Activities Committee. He was a recipient of the 29th IETE Ram Lal Wadhwa Gold Medal for his distinguished contribution in the field of semiconductor device design and modeling. He was also the first recipient of the ISA-VSI TechnoMentor Award given by the India Semiconductor Association to recognize a distinguished Indian academician for playing a significant role as a Mentor and Researcher. The award, presented on 31 July 2007 by Dr. R. Chidambaram (Principal Scientific Advisor to Government of India), includes a citation and Rs. 200,000 reward. He is also a recipient of the 2008 IBM Faculty Award in recognition of professional achievements.

He is an Editor of the IEEE Transactions on Electron Devices. He was the lead Guest Editor for (i) the joint special issue of the IEEE Transactions on Electron Devices. and IEEE Transactions on Nanotechnology (November 2008 issue) on Nanowire Transistors: Modeling, Device Design, and Technology and (ii) the special issue of the IEEE TRANSACTIONS ON ELECTRON DEVICES on Light Emitting Diodes (January 2010 issue). He is the Editor-in-Chief of the IETE Technical Review and an Associate Editor of the Journal of Computational Electronics. He is also on the editorial board of Recent Patents on Nanotechnology, Recent Patents on Electrical Engineering, Journal of Low Power Electronics, and Journal of Nanoscience and Nanotechnology. He has reviewed extensively for different international journals.

Prof. Kumar is passionate about his teaching which has often been rated as outstanding by the Faculty Appraisal Committee, IIT Delhi. He thinks that feedback that he receives from the students is one of the motivating factors for him to be a constant learner which in turn makes him an effective teacher. Prof. Kumar practices Karate and takes out time to be in the gym regularly.

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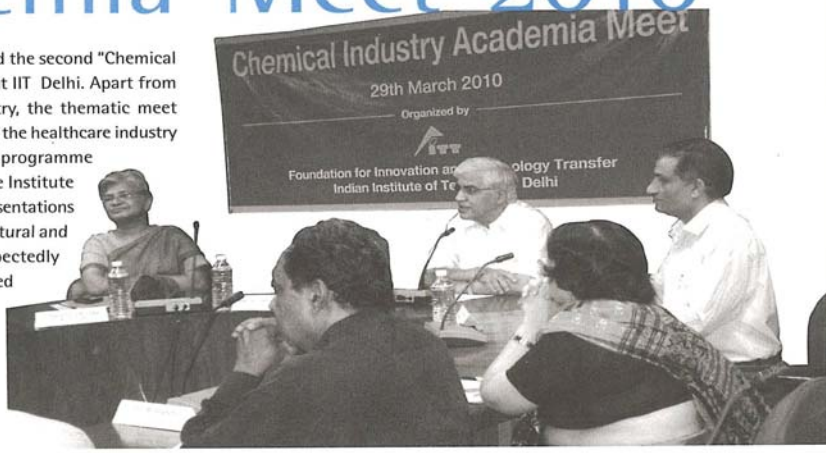
Chemical Industry Academia Meet 2010



On 29th March 2010, FITT organized the second "Chemical Industry Academia Meet 2010" at IIT Delhi. Apart from fostering bonds with the industry, the thematic meet aimed to understand the research needs of the healthcare industry and explore areas of cooperation. The programme involved presentations by members of the Institute and Industry respectively. The Institute presentations highlighted its innovations and infrastructural and intellectual strengths. The industry expectedly outlined its various R&D needs and helped draw interesting research themes. More importantly, this regional Chemical Industry and Academia meet has created a forum for constant dialogue.

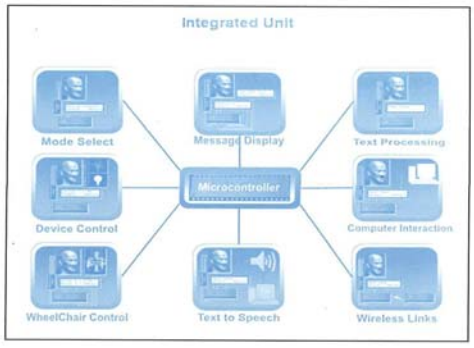
Prof. Surendra Prasad (Director – IIT Delhi) flagged off the meeting with his welcome address wherein he exhorted the industry towards active collaboration with the academia. In her inaugural address, Dr. (Mrs) Jayashree Gupta (CMD, Indian Drugs and Pharmaceuticals Ltd. – Gurgaon) highlighted the important role that academia can play by technological interventions in industry that needs a continuous flow of new knowledge and innovations. The proceedings of the meet were moderated by Dr. Anil Wali (MD – FITT). The presentations from the industry were made by Dr. Rama Mukherjee (MD, ARA Healthcare Pvt. Ltd.), Dr.PK Bhatnagar (Sr. VP – Ranbaxy) and Sh Pankaj Sharma (CEO – LeadInvent Technologies). The Institute perspective was shared by Dr. T.K.Chaudhuri (Biological Sciences), Dr. A S Rathore (Deptt. of Chemical Engg), Prof B Jayaram (Chemistry) and Dr. N G Ramesh (Chemistry). Prof B Bhargava (AIIMS) provided an interesting feature on medical research and more specifically spoke on the Stanford-India Biodesign Programmme. The meeting was attended by about twenty faculty members and several research and graduate students. The industry participants included Mr. Akash Bhavsar, (MD, SkyQuest, Ahmedabad), Dr S Sengupta, (Sr Advisor, CII), The meeting concluded with a comprehensive follow-up discussion round-up and thanks giving by Prof HM Chawla of Dept. of Chemistry.

Automobile Industry-Academia Meet @ I2Tech

FITT organized the "Automobile Industry-IIT Delhi Meet" as part of its regular industry-academia program on April 24, 2010 during I2TECH – Open House 2010 celebrations at IIT Delhi. The industry panellists / participants included Mr.V.S.Goindi (Chairman, The Goindi Group), Mr. Ravi Kapoor (MD, Faros Simulation), Mr. V. K. Sethi (CoEIAI), Mr. B. S. Yadav (Hero Honda), Mr S. Ghoshal (Rico Auto), Vikram Puri (Minda) and Mr. Anuj Guglani. Prof. S.K.Saha (Mechanical Engg., IIT Delhi) gave the welcome address. Prof. K.Gupta (Mechanical Engg., IIT Delhi) who chaired the session actively coordinated the industry-academia presentations / discussions and referred to those areas of IIT Delhi that were of interest to the automobile industry. The IIT Delhi faculty members who spoke / interacted on the occasion included by Prof. L. M. Das (IDDC), Dr. V. K. Vijay (CRDT), Prof. S Mukherji (Mechanical), Prof. K. R. Rajagopal (Electrical), Dr. Ananjan Basu (CARE) and Prof. S. Kar (Electrical). Dr. V Matsaagar (Civil) proposed the vote of thanks.

Electro-Oculogram (EOG) Based Multimode Controller

An Electro-Oculogram (EOG) based system for performing the basic menu operations on a computer has been developed here jointly by the Computer Services Centre and Centre for Biomedical Engineering. The system enables a severely handicapped person to transmit comments to the appropriate menu options on a computer screen by sheer flick of eyes.



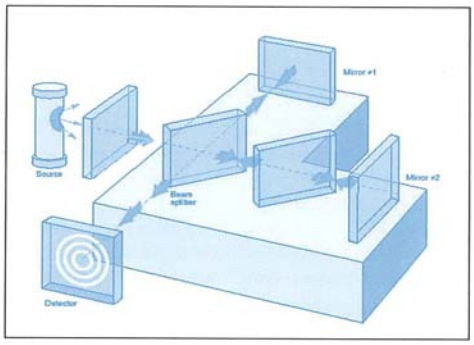
The system implies biometric type conversion of mechanical impulse of the eyelid into electrical signal which can be interpreted by sensor based interface kit attached to the CPU of a computer.

The lab prototype developed had been put on a tentative trial. The proposed design is simple, flexible, portable and power efficient. According to the needs of the user, the unit can be customised.

Applications : Rehabilitation of spinal injury and neuromuscular disorder patients. Other prospective applications : Clinical Diagnosis, Defence.

Method and Set-up for Generating Phase-Shifting and High Spatial Carrier Frequency Interferograms for 3D-Surface Topography

A common path and non-mechanical scanning phase-shifting lateral shearing interferometer based on a novel liquid-crystal cell has been developed by the Instrument Design Development Center at IIT Delhi. Interference fringes with improved contrast and high-spatial carrier frequency have been achieved with the help of this device. The device generates both circular as well as linear fringe patterns under separate geometrical conditions. The design of the device was further modified to generate linear fringe patterns with large area illumination.



The main advantages of the liquid-crystal phase-shifting lateral shearing interferometer (LC-PS-LSI) are non-mechanical scanning, common-path, compact and low-cost device and hence can be used for real time applications. The compact interferometric device can easily be mounted on optical set-ups comprising a collimated or a converging laser beam and optical microscopes and required phase-shifting interferograms can be obtained by applying the voltage to the liquid-crystal cell without mechanically moving any component in the optical set-up. This is one of the most important advantages of the present invention over the conventional phase-shifting interferometers, such as, Michelson and Mach-Zehnder interferometers, where at least one of the optical components is mechanically moved to generate phase-shifting interferograms.

Snippets

Professor N. K. Gupta, has been conferred with J.C. Bose Memorial Award by the Prime Minister of India during the inaugural function of the 97th Indian Science Congress held on January 3, 2010 at Thiruvananthapuram.

Professor S.K. Koul, has been selected for Shri Om Prakash Bhasin Award for year 2009 in the field of Electronics and Information Technology.

Mr. Arvind Chel (Research Scholar, CES – IIT Delhi) & Ms. Geetanjali Kaushi (Research Scholar, CRDT – IIT Delhi) have been declared the winners of the "NEXT GLOBAL INNOVATION CHALLENGE" for their innovation titled " A Novel Hybrid Biomass Solar Cook Stove". They were felicitated during the Golden Jubilee Alumni Convention, organized by IIT,Kanpur on 19.06.2010.

Distinguished Alumnus Prof. A.J. Paulraj (Ph.D. Electrical 1973), Emeritus Professor at Stanford University and Visiting Professor, Bharti School – IIT Delhi gave a talk on '*Why We Need High Tech Industry*' on 21st June' 10 while on a visit to the Institute. He was felicitated for his accomplishment of receiving the Padma Bhushan award for his immense contributions to Science and Engineering

Distinguished Alumnus Manvinder Singh (Vindi) Banga (B.Tech. Mech – 1975) & Ex – President (Foods, Home and Personal Care), Unilever visited the Institute on 9th April 2010. He was felicitated for his achievement of receiving the Padma Bhushan Award for his immense contributions to Trade and Industry and delivered a lecture on '*IIT And Beyond*'.

13 जुलाई, 2010

दैनिक जागरण

सिस्टम खराब होने से पहले मिल जाएगी सूचना

बाधित रहेगी बिजली आपूर्ति

IP Licenses Executed

1) Waterless, Odour-less General Taps For Isolated Toilet Kiosks
   Dr. V. M. Cheriar, Centre For Rural Development & Technology (2 licenses)
   - M/s. Goodyield Environmental Technologies Pvt. Ltd., Kolkata
   - Moneyplant Estates Pvt. Ltd., Bangalore

2) Impact Hammer Assembly, Dr. Suresh Bhalla, Civil Engg. Deptt.
   - M/s. Inov., Delhi

EXPRESS Newsline | NEW DELHI | TUESDAY | JULY 13 | 2010

POWERFUL TIE-UP | THE COLLABORATION WILL FOCUS ON ENHANCING POWER GENERATION, TRANSMISSION

To power research, discom inks MoU with IIT-D

EXPRESS NEWS SERVICE
NEW DELHI, JULY 12

TO ENCOURAGE research in the area of power distribution, BSES Yamuna Power Limited (BYPL) on Monday signed a three-year Memorandum of Understanding (MoU) with IIT-Delhi. An agreement to this effect was signed between Ramesh Narayanan, CEO of BYPL and Dr Anil Wali, Managing Director of the Foundation for Innovation and Technology Transfer (FITT), a society established by IIT-Delhi for enhancing industry-academia interaction and research.

"This is a path-breaking and revolutionary initiative, which is being carried out for the first time in India by a power distribution company and a premier engineering institute. The collaboration will focus on how to improve value proposition for consumers by bringing in the next level of "SMART" technology to the power distribution business and keeping pace with technological innovations taking place in the power generation and transmission business," said Narayanan.

Officials said the collaboration will also focus on providing a better value proposition for the consumers by minimising problems in service through technological interventions. This will further improve the quality and reliability of power supply and find newer methods to reduce distribution losses," officials said.

Complimenting BYPL for the initiative, Dr Wali said, "As power distribution is the most people-interactive interface in the power industry chain, we are pleased to form this association with BYPL and help engineers look at technology from a customer's point of view."

"The ecosystem for a dynamic industry-academia interface has to be fostered. We hope our engagement with BYPL would enable knowledge-sharing and technological innovations," Dr Wali remarked.

For smooth execution of the tie-up, it has been decided that both BYPL and IIT-Delhi will each appoint one principal project investigator to coordinate the scope of work. The cost of the projects will be borne by BYPL.

New Innovations / Opportunities for IP Licensing

SL.No	Title of the Invention	PI/Deptt.
01	A novel Self-excited brushless Single Phase Induction Generator(SEIG) integrated with robust automatic electronic voltage regulator	Prof SS Murthy, Electrical
02	A novel closed loop speed control using carrier space vector pulse width modulated direct torque control scheme for induction motor drive	Prof JK Chaterjee, Electrical
03	Voltage and frequency control of self excited induction generator(Brushless Generator) in isolated three phase four wire system under balanced and unbalanced operations	Prof JK Chaterjee, Electrical
04	Power Factor Correction based Flyback Fed Permanent magnet brushless DC motor Drive for Fan Application	Prof Bhim Singh, Electrical
05	Flexport : A2D, flexible, portable multi plug Circuit pad	Dr Deepti Gupta, Textiles
06	Squatting type Urinal pans for women toilets	Dr V Charier, Rural
07	Fixation of silver nanoparticle on textile substrates for durable antimicrobial finish	Prof AK Agarwal, Textiles
08	An apparatus and method for parasitic Communication	Prof Ranjan Bose, Electrical
09	An apparatus and method for personal area Network and body area network using Magnetic coupling	Prof Ranjan Bose, Electrical
10	Method and Set-up for generating phase-Shifting and high spatial carrier frequency Interferograms for 3D-surface topography And for obtaining linear fringe patterns	Dr DS Mehta, Design
11	A stapler for stapling pins of different designs	Dr Amitoj Singh, Design
12	A novel variant of L-Asparaginase and its Use thereof	Dr Biswajit Kundu, Biology
13	A Novel vibration sensor for concrete Structures	Dr S Bhalla, Civil
14	A method for invoking emergency response In an Electronic Data Acquisition System	Prof S Kar, Electrical
15	Optimal Distribution of complexity for partial Cancellation in VDSL	Dr S Prakriya, Electrical

Professional Candidates' Registration Programme

Contact:
kirityroy@yahoo.com

Applications are invited from qualified professionals working in Industry and Research Organizations for a unique knowledge augmentation and skill enhancement programme at IIT Delhi. This involves a semester-long registration for a regular PG course. Course fees range from Rs. 15,000/- to Rs. 20,000/- (industry professionals) and Rs. 6000/- to Rs. 8000/- (academic/government personnel) for a 42 hour lecture course. In the case of a few select courses, on-site course delivery using the two way video link systems may be considered.

All major disciplines of Science and Engineering, and also relevant courses from the Humanities, Social Science and Management streams which are being conducted at IIT Delhi are covered.

Eligibility: Degree in Engineering or Masters Degree in Science, Management or any other Post Graduate Degree with relevant industry experience. The two semester sessions in the academic year start in the months of July and January ,the exact dates being notified in advance.

List of forthcoming HRD programmes

(July-December 2010)

Sl. No.	Title	Date	Faculty/Dept.
1	SWAT Workshops in India	July 12-16	Prof. A K Gosain, Civil
2	Short course on "Advances in Earthquake Engineering"	July 30-31	Dr. V Matsagar, Civil
3	Training programme on "Bioinformatics and Computational Biology"	Aug. 10 - Sept. 20	Prof. B Jayaram, Chemistry
4	Workshop on Financial Engineering	Sep. 11	Dr. Nomesh Bolia, ME
5	Workshop on "Recent Advances in Environment Friendly Technologies in the Petroleum Sector"	Sept. 16-17	Prof. D K Sharma, Energy
6	Workshop on "Cleaner Power Generation Challenges Ahead"	Oct. 6-8	Prof. D K Sharma, Energy
7*	Short course on "Transportation and Storage of Flyash"	Nov. 15-17	Prof. V. K. Agarwal, ITMMEC
8	Short Course on "Economics and Financing of Renewable Energy Technologies"	Dec. 6-10	Prof. T C Kandpal, Energy
9	Training programme on "Biotechnology Treatments of Biological Wastes and Wastewater"	Feb. 2011	Prof. S N Mukhopadhyay & Prof. T R Sreekrishnan, Biotechnology

*Courses are Participation-Fee based; *Sponsored by CPCB, New Delhi for Govt. Oganisations & participation fee based for private entities*

FITT-Corporate Membership

FITT invites the industry / industry associations / R&D organizations and financial institutions to become corporate members of FITT at a nominal fee. A corporate member client can participate in technology transfer and joint R&D programmes of the Institute on a priority basis with FITT providing the interface. Membership Form can be mailed on request or can be downloaded from www.fitt-iitd.org. Contact parthab@fitt.iitd.ernet.in

The New Corporate Members of FITT (Jan-June 2010)	
Pitney Bowes	Clutch Auto
Auto Ignition	Marathon Electric India
Associated Traders	Deki Electonics .
Anindus Consultants	Dabur Research Foundation
Indication Instruments	Scientech Technologies
Bajaj Steel Industries	Alchem International
Intex Technologies	S.P. Singla Constructions
Bony Polymers	I2 Investments India
BCH Ltd	SRF Ltd.

Development Projects

S.NO	Examples of Development / Investigative Projects	Principal Investigator (Prof/Dr)
01	Analysis and design validation of mounting bracket assembly (Phase-III)	AK Darpe
02	Trans Fatty Acids in Indian Food Items and Effect of Frying Temperature and time on the quality of edible oils	KK Pant
03	Optimal Operation of ETP at Jagatjit Industries Ltd.	TR Sreekrishnan
04	Motorbike Design Research using Eye Tracking	Amitoj Singh
05	Area flood drainage study for the 2x660 MW Kawai Thermal Power Project, Kawai, Rajasthan	AK Gosain
06	Technical Consultancy for Implementation of HCBS on 15KMs stretch of Ambedkar Nagar to ISBT Corridor	Geetam Tiwari
07	Concept Design for CNG / Electric four wheel open public taxi	LK Das
08	Quality by Design (QbD) based Process Development for Biosimilar Products	AS Rathore
09	Batch Digester Scheduling in Pulp Industry	MA Shaik
10	Design and Development of Isolation System for Sonar Transducer Array	AK Darpe
11	Analysis of two-phase flow through fine channels of Porous Substrates	Shantanu Roy
12	Process development and assessment of microbial culture for therapeutic protein production	Saroj Mishra
13	Characterization of underwater acoustic transmission property of materials	Arun Kumar
14	CARS – GMSK and Impulse Radio Noise Suppression Schemes for VLF Communication	Arun Kumar
15	New-Gen Polyolefin Films for Hygiene Applications	AK Ghosh
16	VALORGAS - Valorisation of Food Waste to Biogas	VK Vijay
17	STP AT Greater Noida – Design, Process Validation, Technical Evaluation and Process Optimization	AK Mittal
18	Brand Identity Design for BML Munjal Foundation	Amitoj Singh
19	Study of Combustion of low calorific value gas for commercial application	Anjan Ray
20	Design, Development and Testing of New Chemical Hoods as per ASHRE 110	PMV Subbarao

IIT Delhi Research Reviews (www.iitd.ac.in):

- Nanoscience & Nanotechnology, July 2009
- Transportation Research at IIT Delhi, Oct. 2009
- Advanced Materials Research at IIT Delhi, April 2010

Team

Chairman, Governing Council : Prof. Surendra Prasad, Director, IIT Delhi

Managing Director: Dr. Anil Wali

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