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FITT FORUM

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

Wishing for a resurgent 2009!

Year 2008 has been a challenging one for the country be it the after effects of a global economic slow-down or in facing the scourge of terrorism on its soil. While the resilience of the country in coping with such situations is unquestionable, what is of concern is the duration and depth of the challenges which in turn determines the quality and methodology of response. While it is expected to invite appropriate and substantive measures from the Government with proportionate support from people, several of the ordinary business ar[illegible]ecurity issues, howsoever different on the face, can find commonality in aspects of the intellectual resources that can help in addressing several such topical issues. Seeking partnerships with academia for both contemporary as well as anticipated challenges is both a necessity and a sanguine option in light of complexity of various situations. The academic options vary from providing purely strategic inputs to more elaborate technology solutions. We are sure that such options are being carefully evaluated by the concerned entities both in Government and the industry. The premier technical and scientific institutions in the country will not fail the country in any such challenge be it in a scientific pursuit, in the strategic sector or even in demonstration of technology advancements – Chandrayaan-1 being an ample testimony to such a capability!

FITT, the associate organization of IIT Delhi, has over the years single-mindedly pursued the agenda of putting knowledge into practice. Notable advancement in the imm[illegible]diate past can be cited in the expansion of our Tec[illegible]ology Business Incubation Program. The technology commercialization and professional development programs are on course. The way forward as we move into the New Year is a reiteration of our resolve to significantly augment the quality and scope of our outreach engagement. We see optimism ahead of us. While seeking meaningful technology-oriented alliances, we wish all our stakeholders and well wishers a very bright and safe New Year 2009 – an exuberant year that should enable us to put the difficult past year firmly behind.

Anil Wali

Convocation, IIT Delhi

The 39th Convocation of IIT Delhi was held on August 09, 2008 at IIT Delhi. T chief guest on the occasion was Dr. R.K. Pachauri, Director General, TERI. Pr Sukhdev was honoured with the Degree of Doctor of Science (Honoris Causa) his outstanding contributions in the area of Organic Chemistry, especially Natu Products. In all 147 students received their Ph.D. at this Convocation.

Dignitaries at the Convocation

Professional Candidate Registration Programme

IIT Delhi understands that a part-time M.Tech. education requires a high inten commitment of 3 years and Ph.D. programme even more. Unfortunately, r everyone has the time for making such a long term and involved commitme Therefore, to facilitate focused educational need, just choose a course (from nea 300 plus courses offered each semester) that you would like to attend and regis for it. For the first time, it is possible to get the feel and benefit of IIT De education with just an application form showing interest in a regular course at Delhi (subject to acceptance by the Dept./Centre). Course fees range from Rs.150 - to Rs.20000/- for a 42 hour lecture course spread over a semester of 16 wee In the case of a few select courses, we plan on-site course delivery using the t way video link system.

TePP : FITT invites proposals fror Innovators for financial Support

Contact: E-mail: mdfitt@gmail.com

Contents

Biogas Enrichment and Bottling Technology for Vehicular Use Developed at IIT Delhi

Introduction

In the present era of ever-increasing energy consumption and dwindling fossil fuel reserves, the importance of biomass based, decentralized fuel such as Biogas and Biomass based power generation has been greatly increased. It is a well established renewable and environment friendly fuel for rural energy needs. Biogas is ideally suited for rural applications where required animal or human excreta and agricultural waste are available in plenty. Harnessing such a resource promotes rural industries, agriculture, dairy and animal farming in a sustainable way. This will also increase employment in the rural regions and discourage migration to cities.

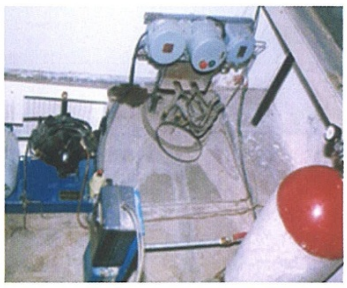
Biogas is an environment friendly, clean, cheap and versatile fuel. Biogas is produced by anaerobic digestion of degradable wastes such as cattle dung, vegetable wastes, sheep and poultry droppings, municipal solid waste, sewage water, land fill etc. Presently the biogas is mainly used for cooking and lighting purposes in the rural areas. The use of biogas in stationary engines used for different agricultural operations is going on. Its utilization is also feasible in automobiles, used for transportation purposes by enriching and compressing it in cylinders. Biogas can be converted in bio CNG after enrichment and bottling. It becomes just like CNG.

Potential of the Technology

So far, biogas has mostly been used as fuel for cooking and running stationary engines. However, it's potential has not been fully utilized, yet. There is a great enhancement in its utilization potential particularly where bigger plants are in operation e.g. institutional biogas plants in *Goshalas*, dairy farms or community biogas plants in villages. *Goshalas* are running generally on charity basis and most of them are not in sound financial position. Enrichment and bottling of biogas will help to improve it.

India has a vast potential of 6.38 X 10^{10} cubic meter of biogas per annum from 980 million tonnes of cattle dung produced. A National Project on Biogas Development (NPBD) was launched by Government of India in 1981. A total of about 36.5 lakh family biogas plants have been installed under this programme all over the country till Dec. 2004. This is about 30 % of the total 120 lakh family type biogas plants potential. More than 3380 Community Biogas Plants (CBP), Institutional Biogas Plants (IBP) and Night-soil based Biogas Plants (NBP) have been installed all over the country with most reporting satisfactory performance levels. The family biogas plants in the country are estimated to be saving 39.6 lakh tonnes of fuel-wood per year. Besides, about 9.2 lakh tonnes of enriched organic manure are being produced every year from these plants.

Due to rising cost of petroleum products and environmental concerns it has become imperative to make use of local resources as an alternate to petroleum fuels.



There are number of *Goshalas,* dairies, village communities having large number of cattle which have potential of installing biogas enrichment and bottling system. In urban areas, large quantity of biogas can be produced in sewage treatment plants using anaerobic digestion. Okhala Sewage Treatment Plant, New Delhi is an example where more than 10,000 cubic meter of biogas is produced every day. Due to rising cost of petroleum products and environmental concerns it has become imperative to make use of local resources as an alternate to petroleum fuels. Therefore, it is a world wide trend to explore and make use of biogas as an alternate fuel in vehicles.

Biogas Composition, Properties and Utilization as CNG

Biogas comprises of 60-65% methane,

35-40% carbon dioxide, 0.5-1.0% hydrogen sulfide and rest of water vapour. It is almost 20% lighter than air. Biogas, like Liquefied Petroleum Gas (LPG) cannot be converted to liquid state under normal temperature. Removing carbon dioxide and compressing it into cylinders makes it easily usable for transport applications, say three wheelers, cars, pick up vans etc and also for stationary applications at various long distances. Already, CNG technology has become easily available and therefore, bio-methane (enriched biogas) which is nearly same as CNG, can be used for all applications for which CNG are used.

Biogas Enrichment Process

A variety of processes are available for enrichment i.e. removing CO_2, H_2S and water vapour. Commonly CO_2 removal processes also remove H_2S. One of the easiest and cheapest methods involved is the use of pressurized water as an absorbent liquid. In this method, the biogas is pressurized and fed to the bottom of a scrubber column where water is sprayed from the top. In counter-currently operated absorption process, the carbon dioxide and hydrogen sulfide present in the biogas is absorbed in down going water and methane goes up and collected in vessel. However, water requirement in this process is high but it is the simplest method of removing impurities from biogas.

Concept of Alternative Bio-CNG

Biogas contains a large proportion (about 40% by volume) of carbon dioxide, a heavier and non combustible gas and some fraction of hydrogen sulphide. Hence it is needed to enrich biogas by removing these undesirable gases to save compression energy and space in bottle and corroding effect, which can be done by scrubbing. The scrubbing system is found to enrich methane about 95 % or more depending upon biogas inlet and water injection pressure. Biogas can be used for all applications designed for natural gas, assuming sufficient purification.

Increasing the number of bottling plants will subsequently increase the Diesel/Petrol savings.

Scope of the Technique

Enriched biogas is made moisture free by passing it through filters after that it is compressed upto 200 bar pressure using a three stage gas compressor. Compressed gas is stored in high pressure steel cylinders as used for CNG. There is large potential of this technology in buses, tractors, cars, auto rickshaws, irrigation pump sets and in rural industries. This will help to meet our energy demand for rural masses thus reducing burden of petroleum demand, moving towards energy security and improving economic status by creating employment generation in rural area.

Therefore, from only one biogas bottling plant, enriched biogas filled cylinders will be able to replace Rs. 9 lakh fuel annually in the country. Increasing the number of bottling plants will subsequently increase the Diesel/Petrol savings. The whole cost can be recovered within two-three years from the installation of the plant.

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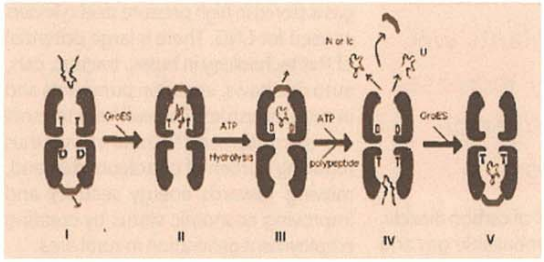
Cylinders filled from one 120 m³ biogas bottling plant = 8 cylinders /day (Capacity 6 kg/ cylinder)

As 6 kg CNG cylinder	= 6 litre Petrol
So, gas filled in these cylinders will be equivalent to	= 6 x 8 (48 litres of Petrol/day)
or Diesel/Petrol savings	= 17520 litres/annum. = 876000 Rs./annum (Approx.) = 9 lakh Rs./annum (from one bottling plant)

Chaperone Assisted Protein Folding in *Escherichia coli*: A significant tool for large scale preparation of recombinant proteins

Escherichia coli chaperones GroEL and GroES are well known for their role in preventing aggregation to the aggregation prone proteins inside the cytoplasm as well assist in the correct folding of newly translated proteins thorugh an ATP dependent pathway. Overexpression of recombinant plasmids in *E.coli* cytosol is a common practice for the production of large amount of recombinant proteins. However, in many cases, the over-produced recombinant proteins lodge into insoluble aggregates in the cytoplasm, because of the lack of sufficient endogenous chaperone for their spontaneous folding. Hence, very often, the process of production of functional recombinant proteins from *E.coli* involves the in vitro folding of denatured proteins followed by purification. These processes are quite often time consuming as well as compromised with the efficiency. Based on the fact that molecular chaperones assist in the correct folding of newly translated proteins in E.coli cytoplasm, we are working on the in vivo GroEL – GroES assisted folding of relatively larger size (> 60 kDa) recombinant proteins. The possibility of misfolding and aggregation is much higher for the larger proteins as opposed to smaller proteins (< 30 kDa). Our studies have shown that there is substantial increment of *in vivo* folding of three E.coli proteins viz., TCA cycle Enzyme Aconitase, Maltose degrading enzyme Maltodextrin glucosidase, and also Malate synthse G, when assisted by co-expressed GroEL and GroES. We have demonstrated molecular mechanism of chaperone assisted folding of these three proteins. Very recently we have scaled up the production of folded recombinant aconitase in a 2.5 liter bioreactor culture through the assistance of co-expressed GroEL and GroES. This has certainly opened up the possibility of large scale production of various functional recombinant proteins in higher capacity of Bioreactors through GroEL-GroES assistance



Mechanism of GroEL-GroES protein folding in E.coli

Significance of the Technique

- It is possible to prepare larger amount of folded recombinant proteins in *E.coli* through in vivo chaperone assisted refolding method.
- Through in vitro process of chaperone assisted protein folding, the purification of recombinant proteins from inclusion bodies also possible.
- It is also feasible to carry out protein folding process through the use of chemical and molecular chaperones.
- Chaperone assisted protein folding in vivo and in vitro is certainly an important technique for the large scale preparation of various kinds of recombinant proteins.

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Natural Fibres and their Technical Applications

Natural fibres present important advantages such as low density, appropriate stiffness, mechanical properties, high disposability and renewability. Moreover, they are recyclable and biodegradable. There has been a lot of research on the use of natural fibres in reinforcements. With the increased consciousness on environmental problems and the demand of environment-friendly fabric, natural fibres have received a great deal of attention.

Automobile giant Daimler Chrysler has been using natural fibres with extremely high tensile strength from the *abaca banana* plant in the standard underbody cover for the spare-wheel compartment of the 3-door version of the Mercedes-Benz A-Class model. They have also been using natural fibres such as flax, hemp, sisal and coconut in the interior of Mercedes-Benz passenger cars and commercial vehicles for many years.

Natural fibres can be used in various products and can be combined with synthetic (thermoplastic and thermosetting polymers) or natural materials like PLA (Biocomposites) for various applications. In the past decade, natural fibre composites have been developed, in which several natural fibres such as ramie, hemp, jute, sisal, bamboo, banana, oil palm fibres, etc. are used as reinforcements in place of glass fibres.

Life cycle environmental performance of natural fibre composites compared with glass fibre reinforced composites show that the former are environmentally superior in some specific applications for the following reasons: (1) natural fibre production results in lower environmental impacts compared to glass fibre production; (2) Natural fibre reinforced (NFR) composites have higher fibre content for equivalent performance, which reduces the amount of more polluting base polymers; (3) lower weight of NFR composites improves fuel efficiency and reduces emissions during the use phase of the component, especially in auto applications; and (4) end of life incineration of natural fibres results in energy and carbon credits.

Natural fibres are extracted from various sources – vegetable, animal or mineral. However majority of the natural fibres which have been used as reinforcements are from vegetable sources. Broadly classifying, the vegetable fibres can be segregated into nonwood and wood fibres. The detailed classification is as given in Figure 1.

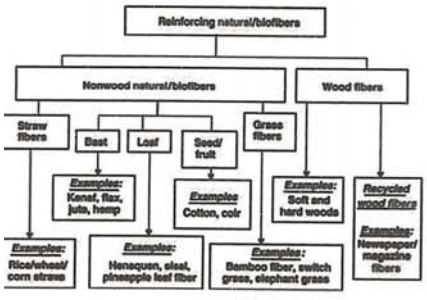

Fig.1 Classification of reinforcing natural fibres

Mechanical properties of natural fibres are inferior to some of the best synthetic fibres. However lower density of the natural fibres make them more viable. The mechanical properties of some of the natural and synthetic fibres have been summarized in a Table1.

Table 1: Comparitive study of natural and synthetic fibres

Fibre	Density (g/cc)	Elongation at break (%)	Tensile Strength (MPa)	Young's Modulus (G
Cotton	1.5	7.0-8.0	287-597	5.5-12.6
Sisal	1.5	2.0-2.5	511-635	9.4-22.0
Jute	1.3	1.5-1.8	393-773	26.5
Polypropylene	0.9	3	670	16
Aramid	1.4	3.3-3.7	3000-3150	63-67

It can also be appreciated from Table 1 that the best commercial synthetic filaments may be compared to the natural fibres. However high performance synthetic fibres like aramid is superior to natural fibres in terms of strength and modulus, though elongation % of many of the fibres in both the varieties is in the comparable range. Industrial extrusion techniques permit better control over the variability of the synthetic filaments when compared to the natural fibres. It is important to note that natural fibres, on an average, are ten times cheaper than the synthetic fibres.

Fig. 2 (a) and (b) shows the variability of natural fibres in terms of their tensile properties. While fibres like bamboo and date are quite stiff, fibres from coconut and date are more extensible in nature.The extensibility values, for example of coir has varied from 17-47 % depending upon sources, method of extraction and various other factors. Those parameters make natural fibers quite complex to handle.[2]

However natural fibres have their share of problems as well. Their hydrophilic nature makes them more vulnerable to

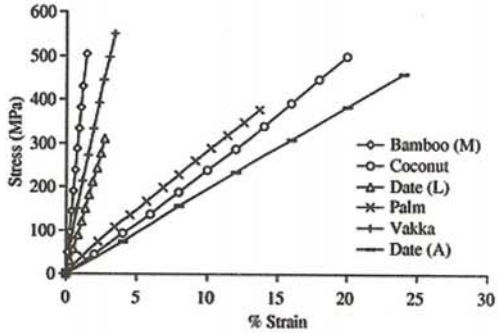

Fig.2(a) Stress strain properties of some natural fibres (Ref[1])

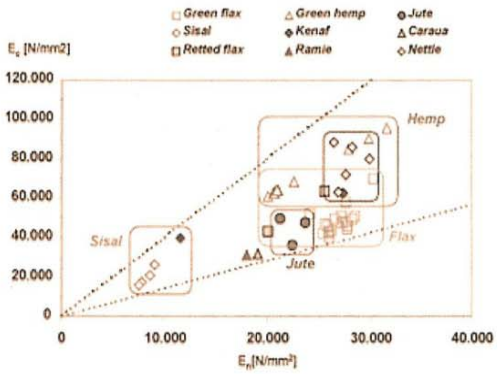

Fig 2(b) Modulus values of natural fibers

degradation. Another major problem with natural fibres during incorporation in hydrophobic polymers is their poor compatibility which has been overcome by modification of either the fibre or the matrix. Often, a compatibiliser like silane or maleic anhydride has been used to overcome this problem.

There have been many ways in which the natural fibres have been used in composite applications. One of the most popular processes has been reactive extrusioin technique (Fig.3) where the matrix and the compatibilizer are mixed and the chopped fibres are fed together to an extruder.

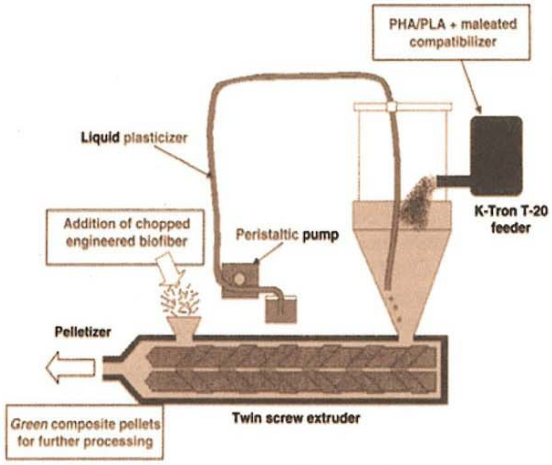

Fig.3 Reactive extrusion processing for bio composites

Research in Textile Department of IIT Delhi

The textile department in IIT Delhi has been quite active in the field of natural fibres and their applications. Faculties of the Department are collaborating with Institute of Natural Fibres, Poland, Budapest Institute of Technology, Hungary, University of Minho, Portugal and Department of Materials, University of Trento, Italy, to modify natural fibres for various applications or develop products using natural fibres. Some of the interesting products developed in the Textile Department at IIT Delhi are underlined as below.

Fig.4 Brecodrain

Brecodrain

A Jute-Coir Prefabricated Vertical Drain (Fig.4) meant for soft-soil consolidation, the sheath of the drain is braided from jute yarns while the core consists of a large number of coir yarns. The entire product is manufactured on a specially designed Braiding machine, designed in the Department, which permits control of pore size, discharge capacity, linear mass and strength of the product. The simple and flexible production machine facilitates production of PVD as per requirement of the end-user. The behavior of this drain in kinked condition has been found to be superior to that of the commercial drains, when tested in the laboratory.

Asphalt Overlay Fabric from Jute

Jute fibre based Asphalt Overlay Fabric has been developed for enhancing durability of flexible pavements through mitigation of crack development and crack propagation. The basic structure of the Jute Grid is shown in Fig. 5. A Non-woven jute fabric would absorb Bitumen and prevent migration of water across

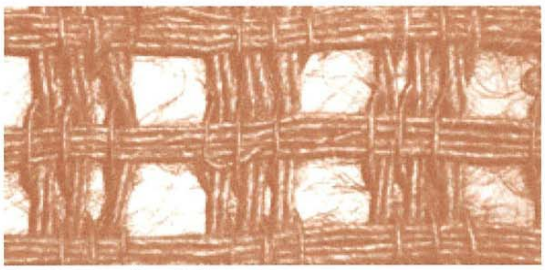

Fig. 5 Structure of Jute Grid

the fabric while the two grids, placed below and above the Non-woven material would provide strength to the Asphalt Concrete and maintain its integrity.

In keeping with the environmental concerns, India would also need to gear up to the use of natural fibres in various forms – specially in the automobile and construction sector. There would be two major challenges as the author envisages – a) devising a way to improve the variability of such fibres and b) improve the thermal stability of such fibres so that they can be used safely with synthetic polymeric materials.

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Start-ups Bail Out IITians Facing Placement Blues

On the back of a global meltdown, big-ticket firms may not be flocking at the premier Indian Institute of Technology (IIT) campuses. IITians, however, not lost all hope. Many are looking

at start-ups for their first jobs. At IIT-Delhi, the response to start-ups is impressive. The Institute, so far, has seen around seven start-ups registering for placements with them against two last year.

(Source: Business Standard, 06-12-2008)

IITians win Shanti Swarup Bhatnagar Awards 2008

Dr Ranjan Kumar Mallik, Professor of the Department of Electrical Engineering, Indian Institute of Technology Delhi, New Delhi has been selected for 2008 Shanti Swarup Bhatnagar prize for Science and Technology. The Bhatnagar Prizes are given to scientists below 45 years of age, for their outstanding scientific contributions made primarily in India during the last 5 years preceding the year of the Prize. The Prize comprising a citation, a plaque and a cash award of Rs.5,00,000/- (Rupees five lakh only) would be given to the recipients by the Hon'ble Prime Minister of India.

Award

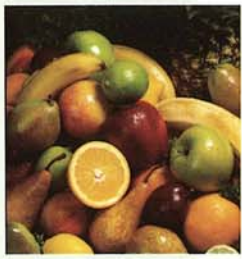
Dr. A.K. Keshari, Associate Professor, Department of Civil Engineering along with Ms. Poonam Binjolkar was awarded "Hem Prabha- S.N. Gupta " prize for the best paper entitled "Estimating geomorphological parameters using GIS for Tilaiya reservoir catchment" appeared in IE (I) Journal –CV, Vol.88, August, 21-26, by The Institution of Engineers (India). The award was given in 23rd Indian Engineering Congress.

Getting Fresh

India produces plenty of fruits. And loses as much too, due to rotting, even while the fruits are en route to consumer. Prom H.M. Chawla of the Department of Chemistry, IIT Delhi decided to counter this problem with his invention – a bio-degradable enzyme made of completely natural elements which, when smeared on fruits or vegetables extends their shelf-life considerably. According to Prof. Chawla "We have made a bio-degradable emulsion which is made up of natural elements that are generally regarded as safe substances GRASS".

The entire process of coating and drying takes about three minutes after which the fruit is ready for dispatch and consumption. Once fruits are coated with this emulsion, their shelf-life is extended at high ambient temperatures varying between "12-45 degrees centigrade." The coating that can be applied by swabbing, spraying or dip-coating the fruits and vegetables, is made of natural elements available in India, Indonesia and Thailand.

According to Prof. Chawla, the coating is completely non-toxic as determined by two independent accredited labs and is also considered safe and included in the FDA list. Dr. Chawla's coating has successfully worked in extending the shelf life of fruits and vegetables like apples, oranges, mangoes, pears, peaches, plums, guavas, lemons, sweet limes, tomatoes, capsicum, passion fruits, almonds, etc. It has been tested that apples coated with the emulsion last for 90 days, while peaches last for 15 days. Prof. Chawla believes that the freshness of fruits and vegetables depends on several chemical, physical and biological parameters like its colour, physiological weight-loss, crispiness, crunchiness, chewiness and aroma. He has documented the same in his tests.



He says. "Currently, there are no international standards for freshness of fruits and vegetables and his group is engaged in developing standards and a computer-assisted imaging system to select or reject the consignment, based on its level of freshness."Prof. Chawla has worked out a reasonable pricing for his coating and says that a coating of Rs.100 will be sufficient to coat about 100 kgs of fruit variety.

(Source: Mumbai Mirror Online, 28-09-2008

Focus on Distinguished Faculty of IIT Delhi

Dr. L. M. Das is currently Professor at the Centre for Energy Studies, IIT Delhi. He took his Bachelor's degree in Mechanical Engineering from the Regional Engineering College, Rourkela in 1970 and M. Tech degree from the Indian Institute of Technology, Kharagpur in 1972. Before joining the IIT Delhi in 1981, he worked as a Lecturer in the University College of Engineering, Burla (Orissa).

His primary areas of research interest include development of alternative-fuelled low emission engine/vehicles. He has published more than 75 research papers in various independently refereed international and national journals in the area of alternative fuels such as Hydrogen, CNG, Biodiesel and Hydrogen-CNG blend. One of his papers "Research Issues in Development of Bio-Diesel Engines' has Secure Energy Future published by The Energy and Resources Institute, 2006. Two of his other papers have been incorporated in a book titled Biofuels towards a Greener and papers "Fuel Induction Techniques for a Hydrogen-operated engine" and "Safety Aspects of a Hydrogen-Engine System Development" have been published in a book titled Hydrogen Fuel for Surface Transportation published by Society of Automotive Engineers,Inc(USA)

Today he is actively involved in several sponsored research projects and has supervised 14 PhD theses (with ten more in progress), and about forty M. Tech Projects in his areas of interest. Hydrogen Engines has been and remains his first love of research for more than two decades. He obtained his PhD from IIT Delhi in 1987 in the area of hydrogen engine and ever since then has been assiduously pursuing R&D activities in this area. He is a member of Advisory Board for International Association of Hydrogen Energy (USA). He was invited to participate and share his research experiences, thoughts and implementation schemes on Hydrogen energy in the UNIDO meetings held in New York (June 2008), Moscow (April 2008), Istanbul (2005), and Philippines (2004). He had also delivered keynote address on this subject in the UNIDO-ICHET (International Centre for Hydrogen Energy Technology) at Istanbul (2004), and was invited to participate in the Expert Group meeting on Hydrogen as an Energy Alternative for Developing Countries organized by UNIDO-APCTT (Asian Pacific Centre for Transfer of Technology) in 1992. He was a Member, Expert Group on Transportation constituted by the Steering Group of the National Hydrogen Energy Board, India (2004) as well as a Member of the CAR (Core group of Automotive Research) of the Govt of India (2003-2004). He is the Convener of the Technical Committee of the World Hydrogen Technology Convention slated for August 2009 at New Delhi.

A strong believer in practical system development, Dr Das has had several consultancy/projects sponsored by UNIDO, General Motors (USA), Shell India, MNRE, and DST. His R&D contribution has been appreciated and a project entitled "OPTFUEL" has been sanctioned by European Union that involves IITD (CES, Engines and Unconventional Fuels lab) as a partner along with ten other Automobile giants/research labs of Europe.

With an effort to transfer the technology from lab to land, Dr Das, in collaboration with Mahindra and Mahindra, has successfully modified one of their three-wheelers to total hydrogen operation. This unit was demonstrated in the Auto Expo 2008 in Pragati Maidan, New Delhi. He has participated in several international conferences in USA, Japan, France, Australia, Singapore, Bangkok and presented research papers on the subject. He was awarded "Rajiv Gandhi Samman" by Department of Science and Technology, Government of Orissa, as an Exemplary Scientist and Educationist for Achievements and contributions in the field of Non-conventional Energy Sources (2005)

Dr. Das has close international research interaction. He was a Visiting Professor at the University of California, Riverside during 2000-2001. He has also worked as a Consultant at the Thornton Research Centre, Chester, England. He also had visiting researcher assignments at INRETS, Lyon, France (1993) and at the Instituto Superior Tecnico, Lisbon in 1994. During his assignments abroad he was involved in research investigations in several frontier areas of research such as Hydrogen-operated Vehicular Engines (USA), Automotive Vehicular Exhaust Emission (France), Laser Diagnostics of CARS (Coherent Antistoke Raman Spectroscopy) technique to quantify "knock" in internal combustion engines (England).

He has lectured in reputed Institutes such as Massachusetts Institute of Technology (USA), Colorado State University (USA), Institute of Transportation Studies, (Davis, California, USA), General Motors Research Lab, (Michigan, USA,) TNO Road Research Institute (The Netherlands), Asian Institute of Technology (Bangkok). Dr Das participated in a meeting in Tokyo in March 2008 as a Member of the CO_2 Environment Technology Advisory Board (TAB) of Renault-Nissan Alliance and shared his technical knowledge on CO_2 reduction strategy with other experts from USA. Germany, Japan, China and France.

Always futuristic and eco-conscious in his research models aiming at sustainable growth and development, he been rather passionate about the use of biodiesel extracted from several Indian non-edible oil seeds in existing diesel engines. He has been involved in the production of such biodiesel and its storage stability including life cycle analysis; and its use in engines to evaluate performance, emission, combustion and long-term endurance characteristics. After exhaustive tests in the lab on stationary engines, two vehicles (one sponsored by General Motors, USA and the other by the Ministry of New and Renewable Energy) are successfully operating on road with B20 (20% by volume of Biodiesel added to Petrodiesel).

Dr Das was a Member of the Editorial Board (2003-2008) of the Journal of Scientific and Industrial Research (JSIR) and was the Guest-Editor of the Special Diamond Jubilee Issue of the Journal on the subject of Energy sources of the New Millennium. He is a member of the research committees and Scientific Advisory committees of DST, DBT and CSIR. He has been a Reviewer for International Journal of Hydrogen Energy and the Journal of Engineering for Gas Turbine and Power (ASME). He has been associated with the Government of India as a Referee for evaluating Research Proposals submitted to DST, DBT and MNRE. He has also been a Referee for evaluating the quality, relevance and feasibility of Research Proposals submitted for funding to FRST (Foundation for Research Science and Technology), New Zealand. He was an Expert/Resource Person for University Grants Commission (UGC) and developed the Syllabus and the detailed course on Vocational Subject on "Non-conventional Energy Sources" introduced at the undergraduate level in various Universities of the country.

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Focus on Distinguished Faculty of IIT Delhi

Prof Ashok K. Ganguli obtained his M.Sc. degree in Chemistry from the University of Delhi (1984) and Ph.D. from Indian Institute of Science, Bangalore in Solid state Chemistry for which he got the Sudborough Medal in 1990. He worked with Prof C.N.R. Rao, FRS on oxide superconductors and related materials. Prof C N R Rao's zeal for research and the attitude to make things work even under difficult circumstances made an impact which would steer the decisions of Prof Ganguli's life. Prof Rao's excitement in science got embedded deep down in Prof Ganguli and this was his source of inspiration when things were not so easy at some stages during the beginning of his independent scientific career. Prof Ganguli is highly optimistic and positive about life and research and pays scant attention to the negativism normally found in abundance in most of our institutions. His training at Indian Institute of Science laid the foundation for a life in scientific research at the interface of chemistry and physics as he interacted with several of the most illustrious Indian chemists and physicists during his years at IISc Bangalore. After his Ph.D he worked at the Central Research & Development Department of DuPont Company (the largest chemical company in the world at that time) at Wilmington Delaware, USA (1990-91) where many great scientists had worked, like Caruthers (discoverer of Nylon) and it gave him an insight into the workings of an industrial giant. In one year Prof Ganguli published eleven papers at DuPont and was enjoying the luxury of corporate life. The trappings of a great industrial R&D organization with more than twice the post-doctoral salary of any chemistry Ph.D did not deter him from leaving (with half the salary) for another experience in fundamental research in one of the finest laboratories (Ames Laboratory, USDOE at Iowa state University) of solid state chemistry of metals and other materials in the world. Here Prof Ganguli had the opportunity to work with Prof John D Corbett, F. N. A. Sc (USA) who is one of the most respected inorganic and solid state chemists of the world. It was among the best decisions in his academic life as the next couple of years were spent on some fascinating new chemistry in the world of intermetallics. It was here that Prof Ganguli learnt the techniques to manipulate unstable materials and also gained knowledge on the subtle aspects of structure determination through x-ray crystallography. The Ames laboratory has the reputation of having a great metals and materials laboratory right from World War II as the uranium was purified in this laboratory for the first time by Frank Spedding and then transferred to Chicago for the atomic pile experiment under the guidance of Enrico Fermi. The training at Ames Laboratory ensured the return of Dr Ganguli to academics back in India (in 3 years which was his target) Though he was offered a position at IIT Kharagpur in 1993 he preferred to work on a temporary position in IISc Bangalore before joining the chemistry department of IIT Delhi in November 1995 and became a full professor in 2006.

His current interests are mainly in the synthesis and properties of nanocrystalline materials (nanoparticles, nanorods and nanocomposites) and their applications. He has extensively worked using the microemulsion method to design nanomaterials with controlled shape and size. He has been invited to write a review on the above area by the prestigious Royal Society of Chemistry, London. In addition he works on metal oxides and chalcogenides for microwave dielectric and cathode applications respectively. However his greatest fascination is for high temperature superconductors in which he dabbles without any specific grant behind the project.

Prof Ganguli has published around 115 papers in International journals and contributed 8 chapters in books. He has published in some of the best journals of chemistry, physics and materials science, namely, J. Amer. Chem. Soc, Inorganic Chemistry, J. Physical Chemistry, Chemistry of Materials, J. Materials Chemistry, J. Materials Research, Chem. Soc Reviews (London), Acta Crystallographica, Physical Review B and Applied Physics Letters. Prof Ganguli has earlier supervised 6 Ph.D students and around 20 M.Sc. and M.Tech. students. Currently he is having 7 Ph.D. students. Prof Ganguli has been invited to deliver research lectures in most of the Indian institutions of repute. He has also been invited to prestigious meetings of the International Union of Pure and applied Chemistry and the American Ceramic Society meetings. Prof Ganguli has also given lectures in several foreign universities like Iowa State University, University of Iowa, University of Delaware, University of Notre Dame, Rutgers University, Rowan University, Shanghai Institute of ceramics, Fudan University and BASF, Singapore.

At IIT Delhi Prof Ganguli has been instrumental in building infrastructure for structural and microscopic studies. Prof Ganguli is very sensitive about the working condition of equipments and considers it equivalent to a crime of not putting equipments bought by national funds to the best possible use and for the maximum benefit to faculty and students. Prof Ganguli makes it a point to respond to every request of any student of IIT Delhi and others regarding measurements in his laboratory. Prof Ganguli has established a very good laboratory for the synthesis of complex solids using various chemical techniques(solid state, molten salt method, polymeric–citrate precursor route, reverse-micellar methods. The materials of interests are complex metal oxides, chalcogenides and intermetallics including nanoparticles , nanorods and core-shell nanostructures. A high level of competence exists in Prof Ganguli's lab to to deal with structural problems with Rietveld refinement of powder x-ray data and single crystal X-ray diffraction, electron microscopy (AFM/STM/HRTEM) and dynamic light scattering. Dr Ganguli has contributed extensively to the field of dielectric, superconducting and magnetic oxides. He has also contributed extensively to the area of polar intermetallics. Recently he has found very interesting results on new oxypnictide superconductors and his group is the only one from India to have synthesized these superconducting compounds (EuroPhys. Lett, 2008).

Prof. Ganguli is the recipient of the Materials Research Society of India Medal for 2006 and the Chemical Research Society of India Medal for 2007.

Prof Ganguli likes to interact with his students on six days of the week while he enjoys the weekends with family and friends. His passion is driving on mountain roads which he does religiously with his family once or twice a year. His goal in life is to synthesize a new superconductor which will break the current record of the transition temperature of ~155 K.

Prof. A.K. Ganguli
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IIT-Delhi, Tokyo University to Study Ganga-Dolphin

WWF (World Wildlife Fund), Tokyo University (Japan) and IIT Delhi have embarked upon a project to study the underwater behaviour of the Ganga-Dolphin (scientific name: Platanista Gangetica) in the Ganga canal region near Narora. The underwater-behaviour study has been undertaken at Karnwas village near Narora, where a specially developed instrument has been installed for the four-month study.

Viveek Sheel, Project in-charge from WWF, told HT that IIT-Delhi and Tokyo University have jointly developed the instrument, which is meant for studying the underwater behaviour of the Dolphins in the region.

(Source: Hindustan Times, 25-11-2008).

Alternate Energy based Efficient Processes and Specialty Materials

The following Technologies are available from IIT Delhi

1. Compact Electron Cyclotron Resonance Plasma Source
2. Scheme for production of Large Volume High Density Plasmas for Industrial applications using Compact ECR plasma sources
3. A method for the synthesis of Mercury Cadmium telluride nanoparticles for photovoltaic thin film application.
4. Design of Externally Controlled Spray Pyrolytic Nanoparticle Fabrication System for generation of specific nanoparticles with customiseable properties viz. ZnO and SnO.
5. An Improved Solar Flat Plate Collector
6. A novel low pressure method of Arsenic removal using modified ultra-filtration membranes
7. Crude Glycerol from Bio-diesel production as a processing aid for industrial explosives
8. Biogas enrichment and compression in cylinders to use it as vehicular fuel
9. A water-ethanol based Alternate Fuel
10. Direct Ethanol based Alkaline Fuel Cell
11. Multi Bladed Vertical Axis Wind Turbine
12. Heat Transfer Apparatus and Method for efficient mixing and heat exchange between fluids

PFAM XVII

The Seventeenth International Symposium on " Processing and Fabrication of Advanced Material (PFAM) was held at India Habitat Centre, New Delhi from December 15-17, 2008. The symposium was organized by IIT, Delhi in association with FITT.

NISSAN Technology & Design Square

A Workshop on "NISSAN Technology & Design Square" will be held at IIT Delhi on January 10 & 11, 2009 at the Student Activity Centre, IIT< Delhi. There will be two presentation viz., Prersentation on "NISSAN Design Strategy and Philosophy" by NISSAN Design Specialist & Presentation on "Future Technology and Strategy".

AIIMS Ties up with Stanford, IIT to Improve Medical Tech

In a first of its kind effort in the country, the All India Institute of Medical Sciences (AIIMS) in collaboration with Indian Institute of Technology (IIT) Delhi and Stanford University, USA, has launched a fellowship programme –Stanford-India Biodesign (SIB) – to improve the Indian medical technology industry.

(Source: Hindustan Times, 15-12-2008)

Seminar on Innovations in Distance Education

A National Seminar on Innovations in Distance Education and their Applications was held at Indira Gandhi National Open University (IGNOU), New Delhi from December 222-23, 2008. FITT in Association with Microsoft and Tata Consultancy Services were the co-organizers of the event.

Incentive-Based Pay Set to Debut with DST

The Union government will soon offer an incentive-based salary package for employees of some departments and allow recruitment from the private sector on contract, in line with the recommendations of the Sixth Pay Commission aimed at reforming the bureaucracy. The Department of Science and Technology, or DST, has already moved to put in place an incentive-based system, said a senior finance ministry official, who didn't wish to be identified. "Once DST implements it, we expect there will be pressure on other government departments to follow suit," this official added. According to the same official, the cabinet has laid down that any government department was free to put in place a performance –related incentive system provided that it is "budget-neutral", meaning that the expense have to be offset through savings in other expenditure.

(Source: MINT, 04-09-2008)

India to Emerge as Global Innovation Hub, says Study

India is all set to emerge as the global hub for innovation, says a Study on the Research and Development (R&D) Ecosystem in the country. Revenues from engineering services, R&D and software products are likely to cross Rs.9,400 crore by the end of this financial year, up 37.5 per cent from Rs.6,800 crore registered last year, according to the study titled 'R&D Ecosystem in India' by research and analytics firm Evalueserve. The R&D ecosystem comprises government departments, research organisations, funding institutions and industry associations. Quoting a study by Zinnov Management Consulting – a management consulting firm in india – The Evalueserve report states that the country's engineering products offshoring could witness a sustained growth of 23 per cent till 2012.

(Source: Business Standard, 16-12-2008)

Indian Scientists 'Must Prioritise the Needs of the Poor'

Eminent Indian science and technology experts have called on the country's premier research institutes to redirect their work towards addressing national development problems and the basic needs of the poor. Key research issues should include clean water, food and sanitation, as well as global warming, said the country's National Knowledge Commission Chairman, Sam Pitroda.

He was speaking at a centenary conference of the Bangalore-based Indian Institute of Science (IISc), one of India's top science research and teaching institutes, on December 15, 2008. Pitroda said that Indian scientists tend to be based in major cities, with the result that people living in smaller districts and rural areas have little access to technological advances. He suggested that India appoint at least one senior scientist to work as a chief scientific officer in each of India's 600 districts, to give the poor greater access to technology.

S. Ramadorai, Chief Executive Officer and Managing Director of global software company Tata Consultancy Services Limited, said that the country needs a national agenda to put its best scientific talent and cutting edge science to addressing national development problems such as basic healthcare, water purification and clean power generation. "Developing societies worldwide depend on [science] innovation as an effective solution to the problems they face," he said. As the global research focus shifts to Asia "India is on the brink of a wonderful opportunity to be a global scientific power", but this can be realised only if it progresses on its developmental challenges, he said.

(Source: SciDev.Net Weekly Update)

Green Ink

One million tonnes of petroleum products are used by printing presses worldwide. These emit 500,000 tonnes of volatile organic compounds (VOC) into the environment during the actual printing process and while washing the printing presses combined (most printing presses have to be washed every day). These VOCs are instrumental in forming 'photo-chemical smogs' and also leading to ozone depletion. Also, people continuously exposed to such VOCs are most likely to acquire ailments such as Asthma, Bronchitis and even Cancer.

A group of engineers, including a professor, all from IIT Delhi have come up with a unique ink, which is environmentally-friendly and doesn't emit any hazardous vapours. The team of innovators includes Sidhartha K Bhimania, Krishna Gopal Singh, Sandeep Mourya and Professor Ashok N Bhaskarwar.

Bhimania explains the printing process, "Typically, printing inks have three components: the resin (derived from petroleum products), the pigment (colouring agent in powdered form) and the solvent added for easy flow-ability (which is also a petroleum product resulting in VOCs). So when the ink comes out in the print, it takes some time to dry. This is when it releases the petroleum product into the environment in vapour form."

So, the solution rolled out by this group which has registered itself under the name of EnNatura Technology Ventures (P) Ltd, is a zero-VOC printing system. Based on functionalised resins derived from renewable feedstock, it uses a vegetable oil-based drying solvent and normal pigment powder for colour.

Explains Bhimania, "The oil-resin mixture dries by a different mechanism. Once the ink is applied on the paper, the mixture polymeries by taking oxygen from the environment. This creates a dry ink film on the surface of the paper. Since, no petroleum products are used and nothing leaves the paper, there is no emission of VOCs. Also, since these resins are special, the ink on the printing presses doesn't need to be washed with a petroleum product and can be merely washed by a regular washing detergent, making it a completely VOC-free process."

This project began with Professor Ashok N Bhaskarwar's research 12 years ago. This system is said to reduce the total operating cost of the printer by 5-15 per cent and provides safer printing and cleaner environment.

Apart from marketing this eco-friendly ink, the group is presently setting up a pilot-plant to produce these resins, that they plan to market to ink manufacturers across the world. Bhimania admits that this strategy would enable them to scale up quickly and also ensure that their creation reaches out to a maximum number of people.

(Source: Bombay Mirror, Dec 14, 2008)

New TBIU Members

Recently three companies have entered the TBIU as new Resident Units.

M/s. Sunurja Renewable Energy Pvt. Ltd.: This unit entered the TBIU in the month of September 2008. The main focus of the company is on Design and Development of Renewable Energy Solutions. (CEO: Dr. Ashish Pandey; Faculty Promoter: Prof. A. K. Agarwala, IDDC)

M/s. Innovative Transport Solutions Pvt. Ltd.: This unit entered the TBIU in the month of September 2008. The main focus of the company is on scientific and technical solutions for traffic and transport systems and development of models for sustainable transport for cities. The Unit is located in the synergy building of IIT Delhi. (Contact: Dr. (Ms.) Anvita Arora & Mr. Sushant Gaurav; Faculty Promoter: Dr. (Ms.) Geetam Tiwari, TRIPP.)

M/s. Faros Technologies Pvt. Ltd.: This unit entered the TBIU in the month of December 2008. The main focus of the company is development of simulator sub components, simulators and providing simulation services. (CEO: Mr. Ravi Kapoor; Faculty Promoter: Prof. S. Mukherjee, DME)

Lecture on Start-up

Prof. (Dr) Martin Haemmig delivered a Lecture titled " Preparing Start-ups for an Economic Downturn" at the TBIU Conference Room, IIT Delhi on November 20, 2008.There were about 40 participants for his lecture from various Industries, Industry-Associations, IIT-Delhi Alumni & faculties and students of IIT Delhi.This lecture was organized under the aegis of FITT.

Dr. Martin delivering the lecture

Technology Transfer Agreement signed & exchanged between FITT and Tektiv Design Labs Pvt. Ltd.

Technology Transfer

The Technology titled "Split Bamboo Composite Panel for Efficient and Cost Effective Solar Flat Plate Collector" which has been developed at IIT Delhi was licensed to M/s. Vin Poly Additives Ltd, New Delhi on October

15, 2008. The Licensed Agreement was executed between FITT & Viny Poly Additives. This technology is in the field of Improved Solar Flat Plate Collectors with high efficiency in heat transfer. The PI of this Project was Dr. P. Sudhakar, Visiting Faculty, CRDT, IIT Delhi.

Current Incubator Companies at TBIU, IIT Delhi

EnNatura Technology Ventures
Development of vegetable oil based environment friendly inks.

Care Pro Biotechnologies
Development of various Bioproducts.

LeadInvent Technologies
A life sciences company focussed on New Drug Discovery.

Appin Security Group
Securing Digital assests etc. Rich client base created

Cozy Deals and Conflict of Interest Mark Indian Patent Grant Process

The rush for patents in India among foreign-owned and large Indian companies in the world's second fastest growing major economy is not new. But as scores of firms and individuals scramble to get protection for their technologies and products, what is coming to light is the cosy relationship between patent controllers, the Indian government officials who decide whether or not to grant a patent, and patent "agents" filing applications for patents. While it is difficult to prove specific wrongdoing in patents being granted, a Mint investigation, activists seeking transparency in India's patent granting process as well as a report by an Austrian government entity all point to a nexus between government officials and private law firms that point to significant conflicts of interest and favouritism in the patent granting process.

(Source: MINT, October 7, 2008)

India Granted 15,261 Patents in 2007-08

A record number of scientific inventions have been patented in the country during the last financial year. The tally of patents is nearly twice that of the year before. The Controller General of Patents' Office granted a total 15,621 patents in 2007-08 as against 7,359 granted in 2006-07. This is a 11 fold rise compared to the tally five years ago.

List of Patent Applications from IIT, Delhi during July-December 2008

S.No.	Title	P.I. / Deptt.
1	Calix[4] arene based Cesium selective extractants	Prof. H. M. Chawla, Chemistry
2	A new catalyst for conversion of ketones to lactones	Prof. H. M. Chawla, Chemistry
3	Novel Calix[4] arene based sensor materials for (a) fluoride; (b) diphosphate and acetate	Prof. H. M. Chawla, Chemistry
4	A process for regioselective formylation of C-alkylated calixarenes	Prof. H. M. Chawla, Chemistry
5	Improvised processes for obtaining isolongifolene ester	Prof. H. M. Chawla, Chemistry
6	Novel Sunscreen cream	Prof. H. M. Chawla, Chemistry
7	A novel T-connected Transformer Connection for Neutral Current Compensation in Three-Phase Four-Wire Distribution System	Prof. Bhim Singh, EE
8	An objective method of quantifying Seam Pucker in stiched Fabrics using Phase-shifting optical fringe projection profilometry	Dr. R. S. Rengasamy, TT
9	An objective method of quantifying Seam pucker in stiched fabrics using grid projection technique	Dr. R. S. Rengasamy, TT
10	Network Energy Scavenging: A Novel approach to on-line recharging of field sensors in a wireless sensor network	Dr. Swades De, EE
11	Breathable Coating for Textile Fabrics	Prof. Ashwini K. Agrawal, TT
12	Fabricating more accurate SLS prototypes	Dr. P. M. Pandey, ME
13	Tailoring properties in rapid prototypes	Dr. P. M. Pandey, ME
14	Development of a novel pollution preventing oil-based microemulsion ink	Prof. A. N. Bhaskarwar, Chem. Engg.
15	Non-isolated transformers for full-wave rectification	Prof. Bhim Singh, EE
16	An Apparatus and Method for Detecting Terror-creating Devices using Wireless Communication	Dr. Ranjan Bose, EE
17	All Digital Phase Locked Loop	Prof. Jayadeva, EE
18	Design Registration for Novel RF Magnatron Holder	Prof. Sudhir Chandra, CARE
19	Protein folding in vivo for overexpressed proteins in Escherichia coli	Prof. M.N. Gupta, Chemistry
20	3-dimensional topography toys using gravitational tunnels as chance / destiny moderatros	Prof.L.K. Das, IDDC
21	Two dimensional to three dimensional elements based creative toy	Prof.L.K. Das, IDDC
22	A transformational construction toy	Prof.L.K. Das, IDDC
23	Design Registration - Styling design of emotional biomimetic vehicular toys inspired by creatures at the coral reef to create environmental consciousness among children	Prof.L.K. Das, IDDC

Training Programmes

Since June 2008, 18 customized HRD programmes were held under the aegis of FITT. A list of some HRD programmes completed/forthcoming are given below.

HRD Programmes (Concluded)		
Sr. No.	**Title**	**Sponsored/Participation**
1.	Training Programme on Industrial Tribology	JCB India Limited, Ballabhgarh, Haryana
2.	Professional Candidate Registration – PG Course Modules for working professionals from Industry	
3.	Fundamentals of Computational Fluid Dynamics	Power Management Institute, NTPC Ltd., Noida
4.	Greater Nagoya Initiative – IIT Delhi Joint workshop – Career Development Program for Foreign Students from Asia in Greater Nagoya	JETRO (Japan External Trade Organization), New Delhi
5.	Remote Sensing and GIS Applications in Hydroelectronics Projects	People Enhancement Solutions, New Delhi
6.	Discussion & Training on "Algorithms and Data Structures	Cadence Design Systems (I) Pvt. Ltd., Noida
7.	Training on Graphics & Software Engineering	Sponsored by Adobe Systems India Pvt. Ltd. at Noida
8.	Training on Graphics & Software Engineering	Sponsored by Adobe Systems India Pvt. Ltd. at Bangalore
9.	Special Course on Low Power Design (1-credit 14 lecture course) under Professional Candidate Registration	
10.	One day workshop on "Introduction to Nanotechnology and its Emerging Role in Industries	Participation based
11.	Training on Optical Network	Ciena India Pvt. Ltd., Gurgaon
12.	CPCB- Training Programme on "Treatment and Reuse of Textile Industry Effluents"	CPCB, New Delhi
13.	Training Program on "Storm Surges"	World Meteorological Organization (WMO)
14.	Agilent Measurement Seminar	Agilent Technologies Pvt. Ltd, Gurgaon
15.	Transportation and Storage of Flyash (Pneumatic Conveying , High Concentration Slurry Disposal and Silo Design)	Sponsored + Participation based
16.	International Course on Transportation Planning & Biomechanics	Participation fee + sponsor
17.	Short course on "Machinery Noise Control and Muffler Design"	Participation based
18.	Training program for Solar PV Design Engineers	Alternate Energy Promotion Centre

HRD Programmes (Forthcoming)				
Sr. No.	**Title**	**Date & Venue**	**PI/Deptt.**	**Sponsored/Participation**
1.	Certificate Course on Embedded Systems & Applications in Telecom	12 January– 22 February, 2009	Dr. Brejesh Lall, EE	Participation fee based
2.	One day workshop on Bioinformatics and Its Emerging Industrial Applications	28 February, 2009	Prof. D. K. Sharma, CSE	Participation fee based
3.	Internship program in Engineering Innovation & Design in Electrical Sciences for PG/UG students	January to August 2009	Prof. Subrat Kar, (Bharti School)	Participation fee based

Technology Development Projects - July-December 2008

S.No.	Title	PI	Deptt.	Client
1	Technical Advice regarding examination of Technical Experience of a Bidder	Prof P R Bijwe	Elect Engg	M/s Power Grid Corpn of India Ltd. (PGCIL), Gurgaon
2	Development of processes for isolation of nucleic acids, enzymes related to nucleic acids and kits related to above	Prof M N Gupta	Chemistry	M/s V B Medicare Pvt Ltd., Hosur
3	Design of Logo	Dr Amitoj Singh	IDDC	M/s Delhi Institute of Tool Engg, Delhi
4	Design Consultancy Workshop	Dr Amitoj Singh	IDDC	M/s Market Xcel Data Matrix Pvt Ltd., N Delhi
5	Design Development and Capability Building of Delhi Toy Industry (Phase-I)	L K Das	IDDC	UNIDO and Industry participants
6	GHG mitigation by renewable technologies using 'Programme of Activities' (PoA) CDM in Rural Energy Sector	Prof. Tara Chandra Kandpal	CES	M/s Deloitte Touche Tohmatsu India Pvt Ltd., New Delhi
7	Technology Transfer "High Pressure Bio Gas (Gobar Gas) Enrichment and Bottling System"	Dr. V K Vijay	CRDT	M/s Excel Electricals Pvt Ltd., Valsad, Gujrat
8	Design of Silicon based Switch and Mask preparation	Prof S K Koul	CARE	M/s Astra Microwave Products Limited, Hyderabad
9	Environmental Examination of the Construction of Boundary Wall in the City Green Area in Sector-95, Noida	Dr A K Mittal	Civil Engg	Noida Authority, Noida
10	Fundamental Studies on Droplet Coalescence and Re-dispersion in Liquid-Liquid Dispersions	Dr Shantanu Roy	Chemical Engg	M/s Shell Technology India Pvt Ltd., Bangalore
11	AMINO – PPX Monomer Development	Dr. Josemon Jacob	CPSE	M/s Vasmed Technologies, New Delhi
12	Evaluation of Polythylene Septic Tanks (2 Nos.)	Dr T R Sreekrishnan	DBEB	M/s Reliance Industries Ltd., New Delhi
13	Design & Development of Unit Cell Model for a Single Bit Phase Shifter using measured data from GAETEC	Prof S K Koul	CARE	Research Centre Imarat (RCI), H'bad
14	Review of Match Engine Design	Prof Jayadeva	Elect Engg	M/s High Mark Credit Informati Services Pvt Ltd., Mumbai
15	Benchmarking and Technology Improvement for Aluminum Composites Panel	Prof A K Ghosh	CPSE	M/s Alstrong Enterprises, New Delhi
16	Recovery of heat and water by condensation of steam from Decoloriser (Line-II) & Dryer (Line-I) (Phase-I)	Dr PMV Subbarao	Mech Engg	M/s Grasim Industries Ltd., Jodhpur
17	Evaluation of existing Air Heater for Line-I & Line-II (Phase-I)	Dr PMV Subbarao	Mech Engg	M/s Grasim Industries Ltd., Jodhpur
18	Reactor Modelling of CVD Process	Dr Shantanu Roy	Chemical Engg	M/s MEMC Electronic Materials, USA
19	Optimization of reaction parameters & process conditions for synthesizing PBZ resins	Prof Jayashree Bijwe	ITMMEC	M/s Macas Automotive
20	Prediction of surface quality and tool wear in end milling	Dr S Ghosh	Mech Engg	M/s Mitsubishi Heavy Industries Ltd., Japan
21	Estimation of emission & fuel consumption of in-use vehicles in different driving conditions	Dr Geetam Tiwari	TRIPP	Petroleum Conservation Research Association, New Delhi
22	Development of MPPT solar charger (100w) as a vehcile for training in solar charger theory & design	Dr M Veerachary	Elect Engg	M/s Delta Energy Systems (I) Pvt Ltd
23	Estimation of buying price for used cars	Dr N Chatterjee	Mathematics	M/s Maruti Suzuki (India) Ltd
24	Design & Development of Airfilter Component into Microcellular Thermoplastic from Traditional Aluminum Casting	Dr Naresh Bhatnagar	Mech Engg	M/s Fleetgaurd Filters Pvt Ltd., Pune
25	Optical Current Sensor	Prof K Thayagarajan	Physics	Electrical Research & Development Association (ERDA). Vadodara
26	Development of new materials for clutchplates under collaborated research	Prof Jayashree Bijwe	ITMMEC	ZF DO Brasil Ltd
27	Biocatalyst Designs and Process Optimization for Biotransformations	Prof M N Gupta	Chemistry	M/s V B Medicare Pvt Ltd., Hosur

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