**Indian Institute of Technology Mandi**
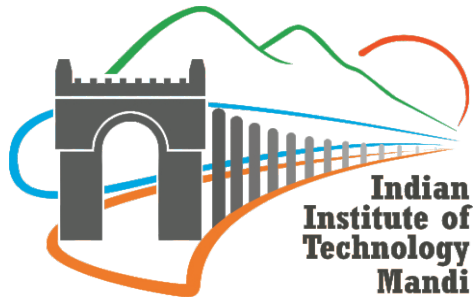
**ANNUAL REPORT**
**2012-13**
Indian Institute of Technology Mandi

# ANNUAL REPORT

# 2012 - 13

# Indian Institute of Technology Mandi

## Mandi - 175001, Himachal Pradesh, India

# VISION

To be a leader in science and technology education, knowledge creation and innovation, in an India marching towards a just, inclusive and sustainable society.

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# MISSION

◈   To create knowledge through team effort and individually for the benefit of society.

◈   To impart education to produce professionals capable of leading efforts towards innovative products and processes for the development of the Himalayan region in particular and our country and humanity in general.

◈   To inculcate a spirit of entrepreneurship and to impart the ability to devise globally recognized solutions for the problems of society and industry, particularly in the fragile eco-system of the Himalayas.

◈   To train teachers capable of inspiring the next generation of engineers, scientists and researchers.

◈   To work intensely with industry in pursuit of the above goals of education and research, leading to the development of cutting edge and commercially-viable technologies.

◈   To operate in an ambience marked by overriding respect for ability and merit

## IIT MANDI GETS LEGAL APPROVAL BY THE ACT OF PARLIAMENT

*With the publication of "The Institutes of Technology (Amendment) Act, 2012 (No. 34 of 2012)" dated June 20, 2012 in the Gazette of India, and notified on June 29, 2012, the Parliament has declared IIT Mandi to be one of the IITs under the "Institutes of Technology Act, 1961". From 29 June 2012, this amendment not only declares IIT Mandi legally at par with the older IITs but also invests IIT Mandi with the legal authority to award degrees.*

# From the Director's Desk

We are proud that IIT Mandi is the first of the new IITs to occupy its permanent campus, a serene 530-acre spread at Kamand in the Uhl River Valley. In April, we broke ground for 11 new buildings in the South Campus. With a floor area of 10,000 sqm, these buildings comprise 10% of the planned Phase 1. They include residential and academic buildings. During the year, a number of renovated Animal Husbandry buildings, some prefab buildings and two brand new permanent buildings were completed and put to use.
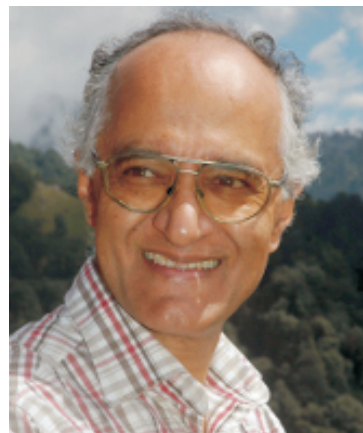
Academic activities have been shifting steadily to Kamand. In March, the Mechanical Workshop started functioning in a renovated hay store. In May, our first sophisticated instrument, a powder X-ray diffractometer (XRD) costing Rs. 1.75 crores, was commissioned. This is housed in a renovated stable, along with a PC Lab, Physics and Chemistry Labs, and a 120-seat Electronic Classroom connected to the National Knowledge Network (NKN). Since August, most of the classes of the 2nd BTech batch have been held in Kamand. The campus has seen several important internal and national meetings including the 1st Academia-Industry Conclave, a national NPTEL review, the Heads of Placement of all IITs and our Senate and Board of Governors meetings.

In June, a few faculty, staff and research students accompanied me, my wife and our dog Rusty in shifting our residence to Kamand. Despite heavy rains and landslides, construction continued at a fast pace during the monsoon. On 23rd September, the brand new Dining Hall was inaugurated and the 108 students of the 2nd BTech batch occupied hostels in Kamand.

I salute the pioneering students, faculty and staff who readily accepted the challenge of becoming the first residents in this campus. Initially, they had to put up with the dust, noise and slush of construction, lack of some amenities, and a plethora of (largely benign) insects. Within a matter of weeks, the campus became a comfortable home complete with canteen, provision store, PNB branch with ATM, sports (volleyball, badminton, TT, cycling, hiking), library, medical centre with our own ambulance, etc. Many of the faculty and staff from Mandi also contributed to the construction, development and use of the Kamand Campus.

The Institute grew in numbers of faculty, staff and students. Significantly, the number of female 1st BTech students went up from 8 (6%) to 12 (10%). The faculty who joined during 2012 included Ph.Ds from some of the best Universities in Europe and North America -- Carnegie-Mellon University, University of Waterloo, Penn State University, and Stuttgart University. The School of Humanities and Sciences increased from 3 to 8 faculty, offering a much richer curriculum to the BTech students.

With its goal of making an impact on society, inter-disciplinary research and teaching is integral to our academic culture. In May, the Senate approved the new B.Tech. curriculum. This is a broad-based curriculum that involves much more teamwork and hands-on design than is traditional. Already, we see significant achievements thanks to the collaborative, inter-disciplary approach.

These include a variety of innovative products developed in the unique *Design Practicum* in the 4th semester of B.Tech.

Highlighting IIT Mandi's commitment to serve society, several faculty came together to start the Centre for Innovative Technologies for the Himalayan Region. This Centre funded by DST aims at deploying technology for the benefit of the rural areas of the Himalayan States.

Theory and experiments are two sides of the coin of science and technology. In an Institute of Technology, strength in experimental research is crucial. To this end, from the day they joined in mid-2010, our faculty started setting up their labs to embark on experimental research. By February 2012, we saw the first publication describing a material synthesised in IIT Mandi's fledgling labs. The paper "2-Aminopyridine derivative as fluorescence 'On–Off' molecular switch for selective detection of $Fe^{3+}/Hg^{2+}$" appeared in the international journal Tetrahedron Letters, barely 18 months after the researchers joined and started literally from scratch. Since then, additional papers have been published, and the newly-installed XRD in Kamand is giving a fillip to experimental research. Despite the nascent state of our facilities, our faculty won a prestigious research project from Intel, USA, worth $315,000 over 3 years. They aim to develop the next generation of organic resists for 16 nm VLSI fabrication.

The best universities world-wide have a strong multi-cultural campus with many students and faculty from different countries. An important part of IIT Mandi's strategy towards excellence is building exchange programmes with partner Universities around the world. The year 2012 saw 6 of our faculty and 2 PhD students visiting the TU9 Institutions in Germany for research collaboration. In October, we signed an agreement with WPI, Massachusetts to establish a Project Centre in Mandi. Every year, 16-25 Third year students from WPI will spend 2 months in Mandi to work on projects related to the interaction of society and technology. They will work in teams with IIT students.

Our first batch of students will graduate in mid-2013. We expect to award degrees to a few PhD and MS scholars and 98 BTech students in the first Convocation. Placement interviews started in December, 2012. Despite the remote location, many companies have chosen to come to Mandi for recruitment. 88% of BTech students have got job offers from Samsung, Amazon, Finisar, Cisco, Microsoft, Infosys, Nucleus Software, Cognizant and others. A number of students have been admitted for higher studies in top research Universities including Toronto University etc.

All work and no play makes Jack (and Jill) a dull boy! In December, we sent a contingent of 120+ students to participate in most of the events of the 48th Inter-IIT Sports Meet in Roorkee. For the first time, the contingent included a few PhD scholars along with BTech students. Our students reached the semi-finals in cricket and the quarter-finals in several other events. The second Tech-Cultural Fest, Exodia was organized in March. This attracted students from many colleges in the Northern region, and some from distant parts of the country to participate in a variety of technical and cultural events. Adventure sports -- repelling down a vertical cliff in Kamand -- was a unique aspect of Exodia.

The year has not been without its set backs. Tragically, a student drowned by accident in the Beas River. Five young faculty bid farewell to IIT, an indication that the advantages of Mandi do not always outweigh its disadvantages. In September, a video of boisterous students in a private party

unfortunately was released to the public. This caused a backlash in the town, which took some time to die down. However, the IIT family came together to weather these trials and indeed emerged stronger, more closely knit.

Placement in India's top companies, blossoming experimental research, a functioning new campus, growing international collaboration are all signs of a healthy and vibrant Indian Institute of Technology.

We are not resting on these modest laurels. Our plans for 2013 include shifting the entire Institute to Kamand. As new buildings are completed in the South Campus, we will migrate from the transit campus in various parts of Mandi to our permanent home in Kamand. By the end of 2013, we expect to have 600 students, 70 faculty and 100+ staff working and (mostly) living in Kamand.

We plan to start new MTech and MSc programmes in several inter-disciplinary areas. By building on the unique strengths of IIT's faculty and its geographical location, we expect to attract some of the best students to Mandi.With the importance of agriculture and horticulture in the economy of the Himalayan states, there is a need for major improvements in productivity by application of novel biotechnologies and biosciences. Likewise, the use of novel bionanomaterials can revolutionise health care. To these ends, we will focus on bioinformatics, synthetic biology and systems biology by hiring faculty and establishing experimental facilities.

An Advanced Material Research Centre (AMRC) was inaugurated by Dr. Pallam Raju, Honb'le Minister for Human Resource Development on 9th March, 2013. This Research Centre will house a High Resolution Transmission Electron Microscope (HR-TEM), 500 MHz NMR, a Single-crystal X-ray Diffractometer (XRD), an FE-SEM, a Confocal Microscope, High Resolution Mass Spectrometry, and many other equipments. It will also have a Class 1000 Clean Room. These facilities at AMRC will enable development of novel materials by our faculty and also provide characterisation services to researchers in the region.To support researchers in IIT and the region, we also plan to install a High Performance Computing Cluster that is in the top 500 world-wide and in the top 10 in India. This will take advantage of the cooler climate for reduced operational (electricity) cost.

Two 3rd BTech students have been accepted for a semester in BTH, Sweden during 2013, and we expect 1-2 BTH students to be on our campus. About 16 students from WPI, USA accompanied by two faculty members are expected to spend 2-3 months with us in Sep-Nov working on projects with our 3rd/4th year students. The other endeavours which are expected to bring significant results during the year include fabrication of a useful device from novel materials devised at IIT Mandi, first start-up company from IIT Mandi thereby making a marked difference in the lives of the people in the Western Himalayan region through our technologies building a vibrant, collaborative, multi-cultural, inter-disciplinary academic culture achieving something totally unexpected. The serene Uhl River Valley in the Himalayas is proving to be an ideal location for world-class research, learning and innovation.

Prof. Timothy A Gonsalves

**Director**

# ACADEMIC STRUCTURE

Academic activities teaching, learning and research are carried out in three orthogonal but complementary structures. These are Faculty Schools, Student Degree Programmes and Research Groups. Each of these is designed to serve a distinct purpose. The three interact in flexible ways to best achieve the academic goals of the Institute. The structure encourages inter-disciplinary learning and research that evolves in step with the march of technological innovation.

Faculty belongs to broadly and loosely defined Schools. Each School provides a home base for faculty whose interests share some fundamental academic principles. Many faculty may have joint appointments in other Schools. Degree Programmes are designed according to the job and career needs of students. A student in a given Degree Programme, say M.Tech (Green Energy), may be taught and guided by faculty from several Schools. Degree Programmes may be started and wound up based solely on job and student aspirations.

Likewise, a Research Group is created as a focus for R&D towards some specific goal. The Group will draw on faculty and students from various schools and Degree Programmes. The Group may have technical and support staff on short-term contracts. Once the goal is achieved, the Group may be disbanded. Depending on its nature, a Group may be virtual with no dedicated physical space. A Group that needs space will get it on lease for a limited duration.

Currently, 4-year B.Tech. programmes are offered in three branches, viz., Computer Science and Engineering, Electrical Engineering and Mechanical Engineering with 40 students in each branch. The curriculum, course structure and syllabi, and the fee structure were initially the same as those of the mentor IIT. The goal of the new curriculum is to train students to become design engineers capable of conceiving, designing and deploying innovative and cost-effective products and processes for wide spread use in the society. To this end, there will be a strong emphasis on laboratory and project work from the first year onwards, to complement theory.

Computer Science & Engineering trains students in programming, theoretical foundations, design of computer hardware and software, networks, artificial intelligence, databases, human-computer interfaces, etc. Electrical Engineering at IIT Mandi includes communications, electronics, VLSI, electric power systems, and electrical machinery. Besides core courses covering all these areas, students will be able to specialize via elective courses. Mechanical Engineering covers materials, manufacturing processes, design of machinery, vehicles, etc. The post graduate courses include MS in Computer Science and Engineering, Mechanical Engineering and Electrical Engineering whereas the doctoral programs besides Engineering Sciences also include PhD in basic sciences like physics, chemistry, mathematics and humanities. During the year 2012-13, fourty two full time faculty and seven visitng faculty from established Institutes like IIT Madras and IIT Roorkee participated in different teaching programs.

## School of Computing and Electrical Engineering

The School of Computing and Electrical Engineering (SCEE) of IIT Mandi aims to maintain excellence in teaching and research in technologies related to Computing, Communication, Electronics and Electrical Engineering. The area of research covers a broad spectrum of theoretical and application based topics such as: smart grid, renewable energy, materials for efficient semiconductor devices, next generation communication and efficient human-computer interaction etc. At the undergraduate level, we emphasize the hands-on learning approach by providing students with a firm foundation of both the theory and practice of Computer Science and Electrical Engineering. We also have joint faculty positions with the School of Basic Sciences and School of Humanities to expose students to the social, ethical, and liberal education to make significant contributions to the society. The first batch of B.Tech. students are likely to complete their graduation and enter the world of innovation as capable engineers or to continue their endeavor in the field of research. At the post-graduate level our faculty provides a deeper mastery of the basics and opportunities for research and professional capabilities for students in the field of Computer Science and Electrical Engineering. Our faculty are engaged in both practical and theoretical research, often in partnership with government agencies, private industry and non-governmental organizations. National and international collaborations are one of the prime focus of the faculty. This aims towards advancement of knowledge within our disciplines and also to contribute to society.

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## Developmental Projects

| S.No | Project | Sponsoring agency | Investigators | Project cost(in lac) |
|---|---|---|---|---|
| 1 | Operation of IT and Network Infrastructure<br><br>Date of sanction: 04.08.2010<br>Date of completion: 03.08.2012 | IIT Mandi | Anand Srivastava | 18,24,000 |
| 2 | Operation and Maintenance of virtual Class Rooms at IIT Mandi<br><br>Date of sanction: 01.01.2012<br>Date of completion: 31.12.2013 | IIT Mandi | Bharat Singh Rajpurohit, Anil Sao | 67,8000 |
| 3 | NKN Electronic Classroom<br><br>Date of sanction: 01.03.2010<br>Date of completion: 28.02.2013 | NICSI | Bharat Singh Rajpurohit, Anand Srivastava | 11,80,000 |

## Research Projects

| | Project | Sponsoring agency | Investigators | Project cost (in lac) |
|---|---|---|---|---|
| 4 | Person authentication using audio-visual biometrics<br><br>Date of sanction: 01.11.2011<br>Date of completion: 30.10.2014 | IIT Mandi | Anil K. Sao | 5,00,000 |
| 5 | Grid connected/stand-alone power electronic convertor control<br><br>Date of sanction: 25.01.2012<br>Date of completion: 24.01.2015 | IIT Mandi | Bharat Singh Rajpurohit | 5,50,000 |
| 6 | Development of text to speech systems in Indian Language<br><br>Date of sanction: 01.01.2012<br>Date of completion: 31.12.2014 | DIT | Anil Sao | 76,90,000 |
| 7 | India-UK Advanced Technology Centre (IU-ATC)<br><br>Date of sanction: 11.09.2012<br>Date of completion: 10.03.2015 | DST | Arti Kashyap, TA Gonsalves, Nitu Kumari, Samar, Sarita Azad, Tricha Anjali Manoj Thakur | 81,48,000 |

| 8 | Centre for Innovative Technologies for the Himalayan Region<br><br>Date of sanction: 28.08.2012<br>Date of completion: 27.08.2013 | DST | Arti Kashyap, TA Gonsalves | 13,86,776 |
|---|---|---|---|---|
| 9 | Aakash Education Proposal<br><br>Date of sanction: 01.08.2012<br>Date of completion: 31.07.2014 | MHRD | Arti Kashyap | 50,00,000 + 25% grant-inaid 12.5 lacs |
| 10 | Structured Programming through E- Learning<br><br>Date of sanction: 01.08.2012<br>Date of completion: 31.07.2013 | BCI | Arti Kashyap, Anil Prabhakar, Hansfangohr | 1,77,07,350 |
| 11 | Computational Nano- Engineering of Patterned Nanostructures<br><br>Date of sanction: 01.09.2012<br>Date of completion: 28.02.2013 | DST | Arti Kashyap | |
| 12 | Surface Plasmon Based Flexible Colloidal Crystal Sensors | SERB | Satinder Sharma | 10,20,000 |

## Progress of the Research projects

**Operation and maintenance of virtual class rooms at iit mandi**
**Bharat Singh and Anil Sao**

This internal projects keeps the e-classrooms/video-conferencing facility fully operational and performing day-to- day maintenance for such high end facility. We have already established the good e-classrooms/video-conferencing facility through the partial funding of NIC, Delhi at IIT Mandi under the project "Creation of Virtual Classroom at IITs over NKN" and these facilities are being efficiently used to hold distant classes, guest seminars, conferences, workshops, regular classes, short courses, conducting interviews and meetings. At IIT Mandi, now we have one e-classrooms of seating capacity of 125 persons and one e-conf. room of seating capacity of 35 persons, at both places, at Mandi and Kamand campus. Generally, we are having, in each academic semester, around 7-8 courses taught by other institutes over NKN while utilizing e-classrooms at IIT Mandi. As per the NIC, Delhi IIT Mandi is one of the highest user of NKN facility with more than 60 % utilization. Now we are planning to augment/extend the same facilities for few more such e-classrooms.

**NKN electronic classroom**
**Bharat Singh and Anand Srivastava**

We have already established the good e-classrooms/video-conferencing facility through the partial funding of NIC, Delhi at IIT Mandi under the project "Creation of Virtual Classroom at IITs over NKN" and these facilities are being efficiently used to hold distant classes, guest seminars, conferences, workshops, regular classes, short courses, conducting interviews and meetings. The objective of the National Knowledge Network (NKN) has been to bring together all the stakeholders in Science, Technology, Higher Education, Research & Development and Governance. The NKN is a

revolutionary state-of-the-art multi-gigabit pan-Indian resource-sharing network aimed at digitally connecting all national universities, colleges and research establishments to create country-wide virtual classrooms. Network will consist of an ultra-high speed Core (multiples of 10Gbps and upwards), and over 1500 nodes. It is scalable to higher speed and more nodes also. The Core shall be complemented with a distribution layer at appropriate speeds. The participating institutions can directly or through distribution layer connect to the National Knowledge Network at speeds of 100 Mbps /1 Gbps. The infrastructure bandwidth will facilitate high speed classroom sessions. The facility can be used to transmit satellite television programmes also. With just 4 megabit connectivity an institution can simultaneously conduct up to 250 classroom sessions. At IIT Mandi, now we have created the similar facility by creating four e-classrooms /conf. rooms. Generally we are having, in each academic semester, around 7-8 courses taught by other institutes over NKN while utilizing e-classrooms at IIT Mandi. Now we are planning to augment/extend the same facilities for few more such e-classrooms. As per the NIC, Delhi IIT Mandi is one of the highest user of NKN facility with more than 60 % utilization.

### Person authentication using audio-visual biometrics
**Anil Kumar Sao**

In audio-visual biometrics speech is utilized together with static video frames of the face or certain parts of the face, and /or video sequences of the face or mouth area.The focus of the work has been to explore suitable representations of audio and video, which will help in efficient  extraction of correlation between the two modalities to recognize the person. The main objectives have been to explore a suitable representation of audio and visual modalities which can characterize  the subject specific unique information and to develop an approach to compensate for asynchrony between audio and visual modalities.

We have have explored the significance of dictionary in sparse coding based face recognition. We primarily address the problem of sufficiency of training data in various illumination conditions. The dictionary has been generated using a lower dimensional representation of image, which emphasizes the subject specific unique information of the face image. This representation is called weighted decomposition (WD) face image, because it attempts to give more weightage to unique information of face image. The effect of illumination in computation of WD face image is reduced using edginess based representation of image, which is derived using one-dimensional (1-D) processing of image. 1-D processing provides multiple partial evidences, which are combined to enhance the face recognition performance. The experimental results suggest that the proposed approach addresses the issue of sufficiency of training data efficiently.  We are also exploring to extract the suitable features from audio-visual modalities and use the compressive sensing based approach to compute the identity of the given person.

### Grid connected/stand alone power electronic converter control
**Bharat Singh Rajpurohit**

In the growing electricity supply industry and open access market for electricity worldwide, renewable energy sources (RES) are getting added into the electric grid system. A significant emphasis is placed on the cost-effective utilization of this energy resource to simultaneously achieve a quality and reliable power supply. Power electronic systems (PES) are the crucial

interfacing devices which matches output voltage, perform DC to AC (or AC to DC) conversion, control power quality and power flow, and have high efficiency on 10% to 100% power range. The objective of this project has been to develop simulations and experimental set-ups for interfaces for RES with grid connected PES control using intelligent and advanced digital signal processing techniques.The literature review has been done. Permanent equipment has been procured. The research team has already developed a detailed mathematical model for common-platform simulation model for 100 kW Solar Photovoltaic (SPV) system connected with power systems and feeding power to it. This common simulation model has been used to compare different switching algorithms performance for an efficient power injection to power systems. An algorithm has been developed for Maximum Power Point Tracking (MPPT) based on Perturb-and-Observe (P&O) method and the Incremental Conductance (INC) method. Recently many Computational Intelligence based algorithms have been developed and tested. Now we working on developing the experimental prototype for validation of hardware and simulation results.

The work will be carried out for developing and testing of a small-scale grid-connected prototype system. The prototype system will be extensively tested under different electric grid operating conditions to examine the response with the RES, the interaction with the battery storage, and the smooth operation of the power conversion and to enhance the controllability of PES based interfaces.

### Development of text to speech systems in Indian languages
**Anil Kumar Sao**

The objective of this work is to develop a Text to speech Synthesis System (TTS) for Rajasthani language. Rajasthani language comprises of five primary dialects - Marwari, Mewari, Dhundhari, Mewati and Harauti.  Our focus will be to build TTS system for Marwari, which is most widely spoken dialects in Rajasthan. In this work we are exploring to build TTS system using the platforms like: Unit Selection based Speech synthesis system (USS) and HTS based speech synthesis.

Work done: We would like to build system and integrate with OCR also which can read contents from website. In order to build system we need a huge corpus of speech in Rajasthani language. Till now we have built Rajasthani USS based TTS for 3.5 hours of female data which obtained a MOS (Mean opinion score) of 3.51(DMOS) and a word error rate of 28.68%.  MOS was obtained after subjective evaluation by 20 subjects.  We have also built USS based TTS for Indian-English for 1.5 hours of data. This system can read the English text also.  We have also built HTS based speech synthesis system using 3 hours of female data.  We observed that synthesized speech using HTS based approach is not natural and the speaker characteristics are not preserved. But HTS based speech synthesis take small amount of memory and can be installed in mobile also. On the other hand we need a lot of memory (relatively) and hence cannot be install in memory. Currently, we are exploring compressive sensing concept to reduce the size of memory of USS based speech synthesis. Compressive sensing is an approach which helps us to sample a signal in less than Nyquist criterion provided it satisfies some predefined conditions. In all these approaches selection of suitable dictionaries play very important role. We are exploring to derive dictionaries which are inspired by speech production mechanism. In addition, we are also exploring approaches which will help in modifying the prosody of synthesised speech.  All the above mentioned approaches will be validated with more amount of data, which will be recorded in another six months.

**India -UK Advanced Technology Centre (IU-ATC)**
**Arti Kashyap, TA Gonsalves, Nitu Kumari, Samar, Sarita Azad, Tricha Anjali and Manoj Thakur**

This is a collaborative project in which a number of IIT Mandi faculty members are collaborating with their colleagues at other IITs as well as in UK. A small part of the project is to deploy a Farmers Advisory System. RTBI, IIT Madras developed a system to provide personalized agricultural advisories through mobile phones to farmers. We at IIT Mandi are replicating it by adapting it to the need of Himachal Pradesh where IIT Mandi is located. In the initial phase, the following locations in Himachal Pradesh are considered:

*i. Locations:*

*Mandi:-* Mandi district is located in the heart of Himachal Pradesh, India, on the bank of byas river. The district has total geographical area of 3950 sq.kms with wheat, maize, Apple, tomato and apple as major crops. Among these crops wheat and tomato have been selected for the phase I of the project.

*Kangra:-* Kangra district is situated on the southern escarpment of the *Himalayas.* The district has total geographical area of 5739 sq.kms with wheat, maize, Apple, tea and potato as major crops. Among these crops tea and potato have been selected for the phase I of the project.

*Kullu:-* Kullu district is situated along the river byas. The district has total geographical area of 5503 sq.kms with wheat, maize, potato, apple and cherry as major crops. Among these crops apple and cherry have been selected for the phase I of the project.

*ii. Baseline Survey*

In order to run the pilot, we have started conducting detailed baseline survey for Apple and Cherry crop in Kullu district. We aim to conduct the pilot by engaging 20 farmers for both the mentioned crops.

*iii. Selecting Farmers for participation:* There are different categories of farmers belonging to marginal, small, medium and large based on landholdings. From the data collected through baseline survey questionnaire, a total of 20 farmers from Kullu are to be selected. The farmer's selection criteria include having a mobile phone, cultivating the crop chosen and willingness to take part in this project. Apple and Cherry are chosen as focus crops for field pilot testing in Kullu district. These crops are chosen because majority of farmers are predominantly growing them in this district.

*iv. Support of Himachal Pradesh Agriculture University, Palampur*

We have signed MoU with Agriculture University, Himachal Pradesh under which we will are able to formally partner with KVK Kullu to handle our pilot run.

Building on some of our previous work we are developing a two-pronged approach to characterize the capacity of general relay channel ... a fundamental problem in information theory that is open for more than forty years. First, we are striving to come up with better achievability schemes. Second, we are trying to generalize some of the recent results obtained for highly specialized networks (namely, symmetric diamond networks) for tighter upper bound computations to more general relay networks.

Another part of the project is to set up cloud at IIT Mandi and the work is in progress.

**Centre for Innovative Technologies for the Himalayan Region (CITHR)**
**Arti Kashyap, Timothy A. Gonsalves**

The mission of the Centre at IIT Mandi is to study, understand and provide solutions to the otherwise ill-equipped rural society in terms of knowledge, technology and awareness. Available technologies will be adapted to the requirements of the Himalayan region. We will use existing technologies but if required we will also put effort in tuning the products for the region specific requirements. The Centre works on deploying the existing technologies to assist various sections of the rural society in Himalayan region ranging from education sector to agriculture and socio-economic activities.

Himachal presents a unique opportunity to avoid the ills of urbanization by rapidly improving the attraction of rural life through appropriate science and technology, on the other hand it is a challenge in itself to understand the societal dynamics of the other two hilly states. This Centre could become a hub of innovation for the rural areas of the entire Himalayan region. IIT Mandi with its vision of a sustainable society for India and its thrust areas is well-suited to take advantage of this opportunity through the Centre.

**Aakash Education Proposal**
**Arti Kashyap**

To create the educational ecosystem with high quality educational content and software tools to deliver the content and manage the learning process, a team from 5 IITs, led by TCOE, IIT Madras is being formed. This team is focusing on the available software tools and the required tools for Indian rural students and teachers. TCOE IIT Madras is the lead member of this team. IIT Mandi is one of the other four IITs working to create android applications towards this ecosystem as per the identified tools and content required.

Aakash Application Development Lab (AADL) at IIT Mandi started in August 1, 2012. Few students who had interest in Android application development formed the team and came forward to work on Aakash. Subsequently few project staff were hired and the activity was formalized.

As a first step, the self-motivated group of few students gave "Beginners workshop" to around 40 students for getting started with Android application development. After that competition about the ideas for developing applications for Aakash was floated. Good ideas were selected and students started working on the applications.

After receiving more tablets we organized workshop for the Government Engineering College in the neighborhood, called Jawahar Lal Nehru Govt Engineering College. Lots of hands on practice were given to the students to give them a good feel of the android application development as well as use of Aakash tablet.

To reach out to students in nearby private engineering colleges, few interns from Shoolini University, Solan (HP) were taken. Just to mention, Shoolini University at Solan had received Aakash tablets from IIT Bombay and students had undergone the training about how to use the

tablet. We trained these interns and workshop on application development on Aakash has been planned at Shoolini University in the month of August where their own student trained with us will help us in parting the training.

Recently, few students from NITs who had interest in android application development also have got involved with AADL, IIT Mandi and working for applications on Aakash.

*Applications under Development*

i. *Data Structure Simulation*-This app will ease the understanding of the data structure and various algorithms.

ii. *Interactive e-Book*- Developing interactive eBook for various engineering subjects to help students in their studies because larger numbers of graduate students are more favorably leaning to e-books.

iii. *Doubt Buster*- It's a teacher student interaction application to solve doubts regarding any stream anytime.

iv. *E-Blackboard*- This application provides interface for free hand writing to take notes. It also contains toolbar of different elements such as: pencil, color, shapes etc.

v. *Easy Engineering*- This application is to perform a role of a handy pocket reference guide for students stepping into engineering colleges who need guidance on different aspects of engineering courses.

vi. *Note Mania*- This app is intended especially for the students to make study easier i.e. taking notes, remembering the important things, setting up the reminders to get alerts about projects/assignments etc.

vii. *Aakash Ayurveda*- It is simple but useful Educational App that makes students aware about various Ayurvedic plants of Himachal region. The information that app contains mainly include plant name, plant common name and medicinal properties. It also provide offline as well as online quiz mode.

**Structured programming through E- Learning, TeTepy**
**Arti Kashyap, Anil Prabhakar, Hansfangohr**
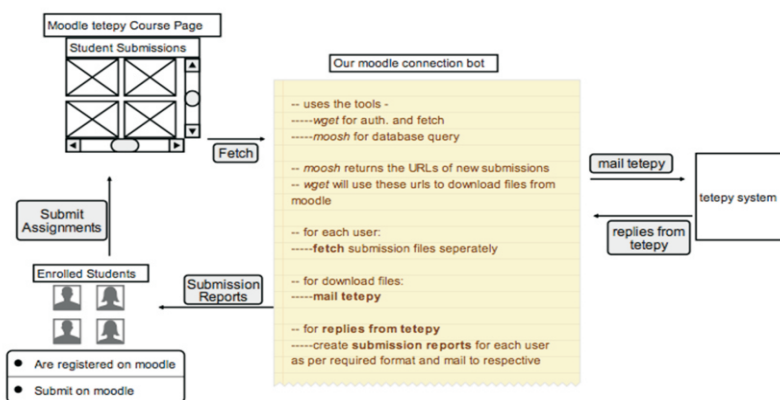


This is a collaborative project between IIT Mandi, IIT Madras and University of Southampton. We have been deploying the e-Learning System on the web server to be used by both UK and Indian partner Institutes. Both India and UK partner institutions have one or more functional deployments of the system and their students are able to use the system. At IIT, the deployment is

usable by students at IIT Mandi & IIT Madras. At Southampton, it is used by students from Southampton and University of Southampton Malaysia Campus. Southampton also has a testing/development deployment live. Further aim of the project was to generate a repository of high quality interesting problems from various areas of Science and Engineering. Southampton already had a repository of quality problems covering programming concepts and some applications such as numerical modelling. Problems identified jointly by IIT Mandi & IIT Madras have enriched the existing repository.

## Computational nano- engineering of patterned nanostructures
### Arti Kashyap

Computational nano-engineering is an emerging field of research aimed at developing nanoscale modeling and simulation methods to enable and accelerate the design and development of functional nanometer-scale devices and systems. Just as microfabrication has led to microelectronics revolution in the 20th century, nano-precision engineering will be a key to the success of the nanotechnology revolution of the 21st century. The driving force for developments in nanotechnology results from the increasing demand related to key technologies like microelectronics and nano magnetic devices. One example is the high density magnetic random access memory (MRAM) technology which has grown over the past decade due to its potential to store more data, access that data faster and also to use less power than current memory technologies. Over the past several decades, amorphous and more recently nano-crystalline materials have been investigated for applications in magnetic devices. Scientifically also, they offer the opportunity to study magnetism in between the atomic and bulk limits. Further nanoconstrictions, multilayered structures of nano-thick films, nanotubes and other nano-geometries are presently the focus of deep interest in this era of new class of materials coming up rapidly.

The objective of the project was to develop multiscale modeling and simulation methods for understanding the nanopatterning of meta-materials and their properties. Phase-vise progress as proposed has been achieved as is evident from the List of Publications. New Observations achieved in this project are: Magneto electric effect in thin films, not proposed in the project initially, was studied. We used first-principle calculations to study the influence of external electric effect on the magnetic properties of L10-ordered CoPd films. Our calculations show that an electric field yield substantial change in surface magnetization and anisotropy, due to change in the surface electric density at the Fermi level.

# School of Engineering

School of Engineering is working towards vision of the institute. School is committed for high standard of engineering education through outstanding teaching, innovative curricula, and research activities. School offers number of courses which are common for all the branches like Design practicum, Reverse engineering, Graphics for design, Materials science, Manufacturing processes and Engineering thermodynamics along with core courses of Mechanical stream.

School of Engineering has 12 faculty members including 3 mentor professors. There are currently 2 postdocs, 10 Ph.Ds and 12 MS students in the school. The main areas of research are broadly classified as materials and design, thermo-fluids engineering, energy efficient buildings and Infrared signatures. In materials and design, the work is directed towards development and analysis of materials for the sensor, actuator, energy harvesting applications and analysis of the smart structures and systems. In thermo-fluids engineering, faculty members have been investigating radiative heat transfer, nano-scale heat transfer, flow analysis and heat transfer analysis of IC engines. Additionally, molten metals/alloys are also being explored in our school. Energy efficient systems cover climate change studies, applications of phase change materials towards energy efficient buildings, use of non-conventional energy sources in IIT Mandi to enhance energy efficiency and development of energy park. School also organized a short-term course on Computer Aided Drafting for Engineers and Designers. The course drew 32 candidates from organizations like DRDO, Irrigation & Public Health Department, industry and academia. School also organized a one week short term course on 'Finite Element Method for Engineering Applications'. The main objective of this 5-days short term course was to introduce the fundamentals of finite element method to the participants to solve problems in different engineering disciplines viz. solid mechanics, structural dynamics, fluid mechanics, heat transfer, electrical circuitry network and to familiarize the participants to programming utilized in implementing the Finite Element method. The school has successfully installed various equipment in Solid Mechanics and Materials laboratories.

## Faculty

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# Developmental Projects

|  | Project | Sponsoring agency | Investigators | Project cost (INR) |
|---|---|---|---|---|
| 1. | Setup materials laboratory<br><br>Date of sanction: 23.08.2012<br>Date of completion: 23.08.2014 | IIT Mandi | Rahul Vaish& V.S.Chauhan | 40,000,00 |
| 2. | Setup theory of m/c laboratory<br><br>Date of sanction: 13.03.2012<br>Date of completion: 13.02.2014 | IIT Mandi | V.S.Chauhan | 48,000,00 |
| 3. | Setup and operation of Mechanical Workshop<br>Date of sanction: 15.06.2011<br>Date of completion: 14.05.2013 | IIT Mandi | Rajeev Kumar | 3,60,000 |

# Research Projects

| S.No | Project | Sponsoring agency | Investigators | Project cost (INR) |
|---|---|---|---|---|
| 1. | Active control of vibration using fuzzy logic controller for smart structure and its experimental validation<br><br>Date of sanction: 19.03.2012<br>Date of completion: 18.02.2015 | IIT Mandi | Rajeev Kumar | 5,13,000 |
| 2. | Glass and glass-ceramics for electrical energy storage devices<br><br>Date of sanction: 01.04.2012<br>Date of completion: 31.03.2017 | DST | Rahul Vaish | 35,00,000 |

| 3. | Solid dielectrics for energy storage applications<br><br>Date of sanction: 25.07.2012<br>Date of completion:24.06.2015 | IIT Mandi | Rahul Vaish & Akansha Dwivedi | 15,00,000 |
|----|----|----|----|----|
| 4. | PCM based energy efficient buildings<br><br>Date of sanction: 25.04.2012<br>Date of completion: 24.03.2015 | IIT Mandi | P. Anil Kishan | 6,00,000 |
| 5. | Studies on electromagnetic radiation response of sintered powder preforms<br><br>Date of sanction: 03.09.2012<br>Date of completion: 02.08.2015 | IIT Mandi | Vishal S. Chauhan | 6,75,000 |

## Progress of the Research Projects

**Active control of vibration using fuzzy logic controller for smart structure and its experimental validation**
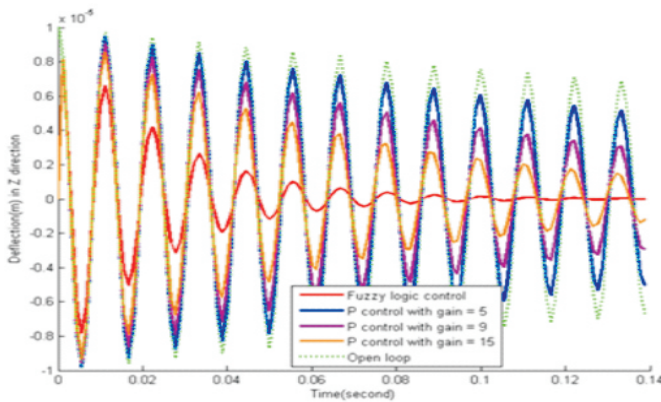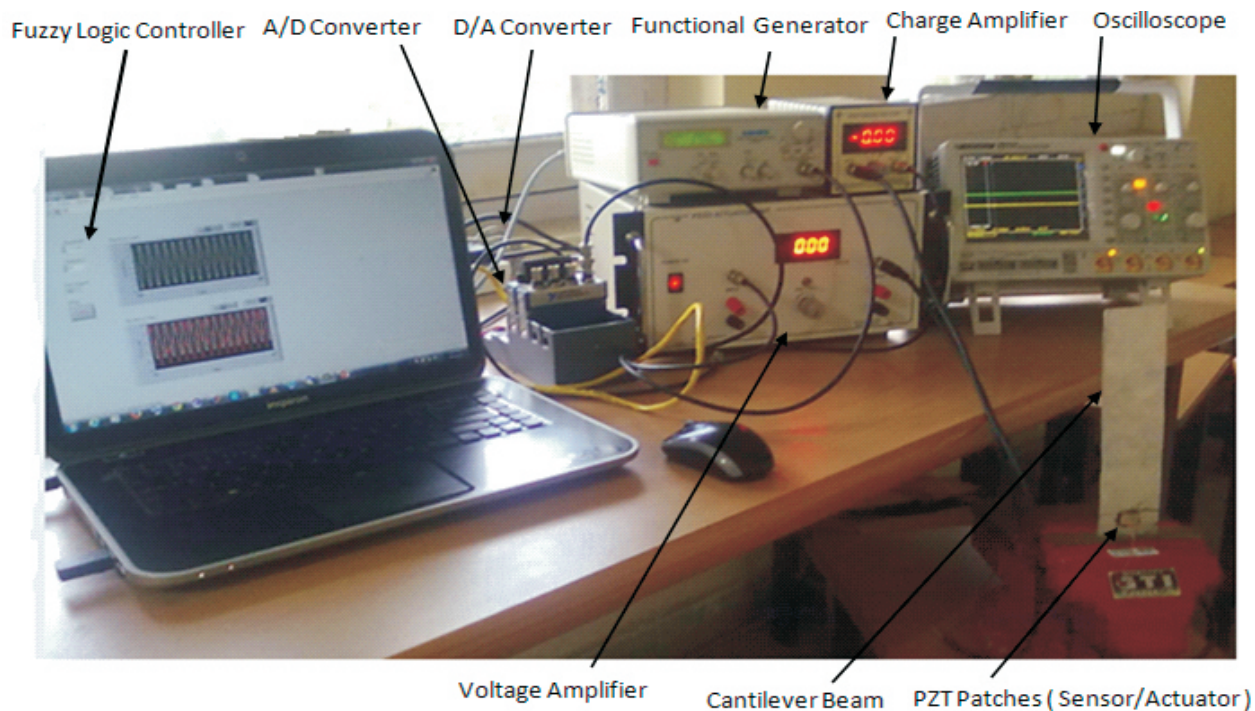
**Rajeev Kumar**



Figure1 : Vibration control using Fuzzy Logic controller and other conventional controller

In this project, numerical study of active control of vibration using fuzzy logic controller for smart structure and its experimental validation was proposed. Numerical study has been conducted using finite element modeling. The Fuzzy logic controller response was found to be better than the conventional controller because it dampened the vibrations faster than the conventional controller. An experimental setup is being developed for validation of numerical results. Set up for active vibration control of structure.

Fuzzy Logic Controller  A/D Converter  D/A Converter  Functional Generator  Charge Amplifier  Oscilloscope

Voltage Amplifier  Cantilever Beam  PZT Patches ( Sensor/Actuator )

Set up for active control of vibration

**Glass and glass-ceramics for electrical energy storage devices**
**Solid dielectrics for energy storage applications**
**Rahul Vaish & Akansha Dewedi**

*i.      Setting up the glass fabrication and testing laboratory:*

Purchase of three conventional furnaces (upto $1100^{\circ}$C) and one specialized glass furnace (Nebathermup to $1600^{\circ}$C) has been made which is the very basic requirement for the fabrication of glasses. Other vital instruments including X-Ray diffraction (XRD), Polarization-Electric field (P-E) analyzer, optical microscope and Differential Scanning Calorimetry (DSC) have been purchased and installed.

*ii.      Fabrication of high energy density glasses*

Transparent glasses in the composition $SrBiB_2O_7$, $BiB_3O_6$, $Na_2O$-$CaO$-$K_2O$-$B_2O_3$ (molar ratio) were fabricated using the conventional melt-quenching technique. For this, starting materials were melted in a platinum crucible at appropriate temperatures (near melting temperatures). The melts thus obtained were quenched by pouring on a stainless steel plate maintained at 300K and pressed with another plate to obtain glass plates up to 1mm thickness. All these glasses were annealed well below the glass transition temperature of the above reported compositions. The complete process is represented in the flow chart. X-Ray powder diffraction studies were performed on powder samples to confirm their amorphous nature. Differential scanning calorimetry (DSC) runs were carried out to determine glass transition temperatures. Finally P-E loop analysis was done using Sawyer-Tower circuit to determine the energy density of the glass plates. The plates were coated
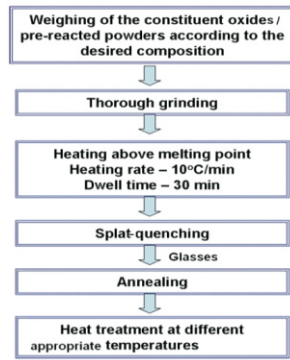
Flow chart for melt-quenchtechnique
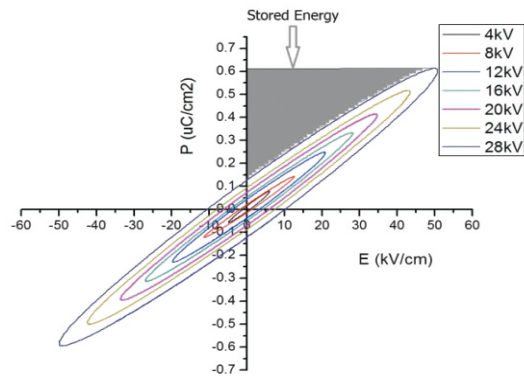

P-E loop for SrBiB$_2$O$_7$ glass

with silver paint (electrode) and the P-E loops were obtained at 300K. Energy density of 15mJ/cm$^3$ was observed.

Borate-based glasses were fabricated and characterized for structural and energy storage applications. Energy density of 15 mJ/cm$^3$was observed for SrBiB$_2$O$_7$ sample using P-E loop. These materials can be used for transparent capacitor applications. Efforts are being made to improve energy storage capacity of these materials.

### Phase change materials (PCM) based energy efficient buildings
### P. Anil Kishan

For thermal energy storage, space heating and cooling and low temperature solar thermal applications organic and inorganic PCMs are available. Many modeling techniques have been proposed for simulating phase change of a PCM or PCM based structure. Most of the investigators have considered 1–D, 2-D and 3-D transient conjugate heat transfer (convection and conduction) simulations for PCM based walls and room domain besides wall domain have not been taken into consideration. The main problem involved in such modeling is considering the transient behavior of the phase change materials. An important phenomenon occurs during the solidification of the PCM, when during the extraction of the stored energy, the liquid freezes close to the heat transfer surface and a moving boundary layer of solid material continuously grows as it releases its heat of fusion. During the melting process, opposite happens. Besides, properties vary with composition of the salt. Proper optimum configuration of different layers depends on the ambient temperature variation and the desired room temperature limits and room size, besides ventilation and occupancy.

We aim to study energy efficient buildings using PCM. In this context, temperature measuring devices were purchased which are needed for measuring and storing the temperatures. These devices measure the ambient temperature at the specified intervals of time ranging from 1 minute to 1 hour. This device can store huge amount of data without any laptop/computer. The temperature of environment is under measurement which is the main requirement for the current study. For the simulation of the current problem, one needs to solve 3 – D equations in unsteady manner. These equations need to be solved numerically to find the exact temperature distribution within the room, walls, and environments. In general, the PCMs have to be encapsulated to avoid

the liquid leakage. Due to this encapsulation, there will be some resistance to the heat flow. This parameter is being considered for the current study.

Experiments are planned to decide the effect of resistance heating in closed environment. Experiments will be conducted in the winter due to the requirement of the cold conditions. Before working with the experimental setup, one needs to study the effect of cold environment on the heat transfer through the walls without the PCMs. For this, experiments are planned and fabrication has been started. Actual experiments will be conducted after the simulations are done. Software identification and purchase process has been initiated. This software is needed to simulate the real conditions before performing proper experiments. The simulations involve solving of partial differential equations with appropriate initial and boundary conditions. This involves discretizing the domain into large number of small volumes and solves the equations for each and every cell. Once the equations are solved for the given conditions, results will be validated with the available results.

### Studies on electromagnetic radiation response of sintered powder performs
**Vishal S. Chauhan**

The main aim of this project is to develop a material through powder metallurgy process which can give large amplitudes of electromagnetic radiation during deformation. To achieve this goal the study is planned to be carried out in different stages such as studying the nature of EMR from sintered powder performs, developing a physical mechanism for EMR emission during deformation and fracture of sintered powder performs, and to explore the powder metallurgy towards development of an element which can give highest EMR output (amplitude) by lowest input (mechanical stimulus). In this context, we have purchased an Oscilloscope, metals and other important accessories. Some trial experiments with the existing material test set up have been carried out. Fabrication of relevant test samples are planned.

**Few major instruments in the School of Engineering are:**
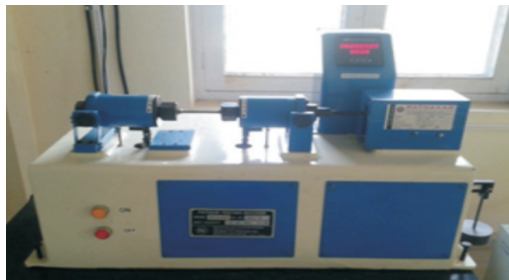


Fatigue Testing Machine
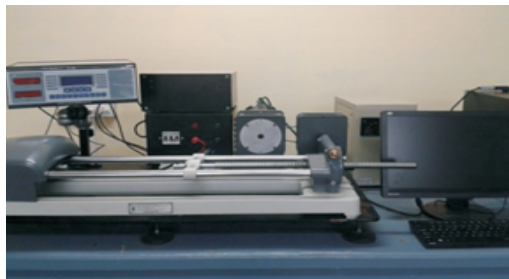


Tensometer



Rockwell Hardness Tester



Impact Testing Machine

A well equipped workshop has become operational. This workshop has a variety of machines including CNC lathe machines, CNC milling machines, power hacksaw, pillar drill, bench grinding machine, spot welding machine, gas and arc welding equipment, sheet shearing machines, etc. It has an assortment of hand and foundry tools. 2nd B Tech students are using these facilities to fabricate products for their Design Practicum projects.



We have also installed 3D printer in our Workshop which is commonly used to produce physical models for a wide variety of applications, from archaeology to industrial prototyping and design. While having been available for more than a decade, the technology recently developed additional momentum



*3D printer and a fabricated prototype*

During the academic year 2012-2013, the thermo-fluids laboratory was also set up. Various components were purchased for performing a number of fundamental experiments. A number of experimental facilities were fabricated by the students. This laboratory is equipped with the following instruments:

1. ADAMS Data acquisition card for temperature measurements
2. Instruments for measuring temperature, humidity, flow velocity, atmospheric pressure and

pressure difference, volume flow rate
3. Cut sections of diesel engine, petrol engine and gas turbines.
4. Working Models of Pelton turbine, steam engine
5. Bomb Calorimeter
6. Microphones and accelerometers for acoustic experiments
7. NI data acquisition system

The experimental facilities have been developed for:
1. Natural Convection
2. Forced Convection
3. Heat exchanger
4. Thermal conductivity
5. Losses in pipe network
6. Characteristics of series and parallel connection of centrifugal pumps
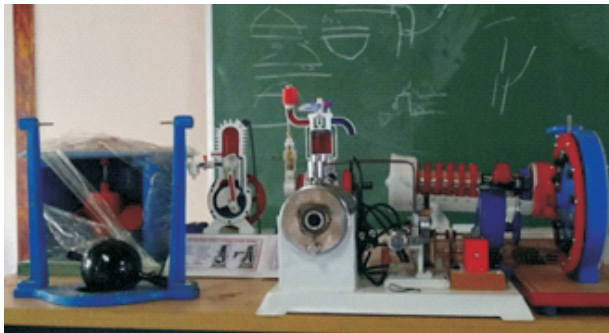


Experimental set up in thermo-fluid laboratory

# Design Practicum

The Design Practicum is a course designed to cultivate product design and development skills among engineering students. This is a one-semester course in which students were asked to design and build innovative products that address real world problems in our society. Interdisciplinary teams of six students each were randomly formed from electrical, computer science and mechanical engineering branches. Each team of six students reported its progress to an interdisciplinary team of four faculty members drawn from engineering, science and humanities disciplines. In the first week the students were informed about some basics of designing and developing a new product, during the second week they were asked to talk to people and prepare a list of problems faced by people and also a list of new ideas that will help to solve these problems.

Out of these several ideas they were asked to pick a few and come up with a product design. After thorough analysis of the feasibility and other parameters like time and cost etc., one of the designs was chosen for product development. At this stage they prepared a budget and got approval from the faculty mentors. After detailed designing they prepared a mock-up and analyzed the pro's and con's.  Next, they worked hard on building a real model prototype that works.  This stage was really challenging as they faced many common problems like getting things in time, compatibility of components brought for different purposes and finally getting it work. On the final day the students demonstrated their prototypes for public display. At the end of the day satisfaction and benefit the student derivedwas immense which will stay with them forever.

**The following prototypes were developed during the year.**

**Cost Efficient 3D Printer**

This product makes the real model of an engineering drawing saved in computer. In simple words, it is a device connected to the computer which can produce objects on demand at a relatively low cost. The product is just a Computer Science application which programs a microcontroller (Electronic Science), which sends signals to the device, which prints the part (Mechanical Science).



**Hybrid Mobile Charger**

The charger developed was abl to charge the mobile from electricity, solar as well as wind energy.  All three modes of charging are provided together with a switch for different modes to operate.

## Volumetric 3D LED Display

Persistence of vision displays uses the limits of human motion perception to create the illusion of continuous images using fast-moving display components. The 3d volumetric display is made extremely high display industrially and is intended to be cheap enough so as to bring true 3d visualization tools into the hands of the common user.

## Intelligent Parking System

The system developed is an engineering solution to park vehiclesin the bigger parking areas. As soon as the vehicle approaches the entry gate, automaticallya parking slot number is generated on LCD and also way for the vacant slot is indicated.

## Multipurpose Humanoid Hand

This product mimics a real life hand. The user wears a glove on his hand on which electric sensors are attached. Sensors convert the movement of human hand into electric signals and send it to microcontroller. Output of microcontroller is sent to servo motor, which provides movement to the mechanical hand. Thus, mechanical hand replicates human hand motion.

**Shelf Moving Clothes Rack And Folding:**This product helps to dry clothes and fold them into almirah once they are dried. It also has the facility to prevent the clothes from getting wet if it starts raining .The product uses solar energy to dry the clothes.

**Automatic Wheel Chair-cum Bed**

This product is developed for disabled person who cannot walk and work himself. It provides him /herthe facilities like a comfortable bed and automatic movement of chair, so the person doesn't need help of anyone to go to bed or to move in house for doing the daily works.It is also economical.

**Dust suppression water sprinkler**

This product suppresses the dust andsprays water automatically without human involvement. A solvent is used to cleanse the dust and its dissipation is carried in an appropriate manner using the data obtained from the various sensors placed at different angles covering whole of the space in the vicinity.

**Hardcopy to Softcopy Convertor**

The product is basically an economical fast image scanner which can scan an entire book automatically without the hassle of turning the pages of book.

**Automatic Robotic Floor Cleaner**

This product is developed to clean, wipe and dry the floor. It has several sensors, which detect walls and other obstacles which helps in deciding which direction to proceed. It has vacuum cleaner to take dust from the floor, a sponge to clean the floor and a fan that dries the floor.

## Automatic paper recycler

This product takes used paper automatically once the paper is placed on machine using the same principle as that of Xerox machine. It is then dipped into the bleaching water which deinks the paper by dissolving the ink in it. This wet paper is dried out for making it reusable.

## Movement Tracking Device

The main use of this product is to give feedback on the amount of activity that a healthy person should perform in order to be deemed as physically fit. The feedback received by a person will take into account the age, sex, height and weight of the individual and generate data regarding the individual's physical fitness. Advice/Feedback on the individual's health can also be given including the suggested exercises and walking/jogging activities.

## Bike on the back

This innovative product is portable cycle, that has features charging mobile, lighting a flashlight, speedometer and odometer .It is also equipped with a display having Institute Guide that have the map of whole Kamand Campus with all the important spots like Academic Building, Research Center, Hostel highlighted along with the path connecting these nodes.

## Seed Sowing Robot

This product sows the seed in earth. The product is wirelessly controlled by the user so that he doesn't have to be present in the proximity of the robot all the time. The product has different seed containers and seed sowing mechanisms for different kinds of seeds. The product consists of motors and a high-powered rechargeable battery.

## Automatic Trash Compactor

This product provides an effective and safe solution to the waste management for heavily trafficked areas. In an era where paper, plastic and aluminum cans have become a staple for packaged goods, their proper waste control has become a problem. The compactor compacts waste up to a third of its original size. It dramatically improves the efficiency of waste handling and eliminates eventual damage to the environment



## Home Automation System

Home automation system is primarily used to control and monitor the entrance foyer with the help of an android device and in-hole camera



## Auto-Navigation Tool for Blinds

This product supports activities of the visually impaired without help of others. This product provides freedom of movement and ensures safety to blind people. The sensory elements and traditional cane help in obstacle detection. The GPS/ microcontroller help in choosing right direction with the use of vibrators/speech synthesizers.



## Automatic Braking System for Railways

It is an engineering solution for automatic braking system for trains to avoid collision. This system consist of radio transmitter and receiver mounted on the trains for the purpose of broadcasting signals in such a way that when received on a receiver some other train would tell it about its speed, position and the distance between them.

# School of Basic Sciences

The school of Basic Sciences at IIT Mandi is a cluster of disciplines of Mathematics, Physics, Chemistry and Life Sciences. The core of the school consists of  27 faculty having expertise in contemporary fields of research .The school started its Ph.D. program in 2011 and presently  54 research students have enrolled to pursue research in various disciplines. The school aims to create an ambience for the smooth pursuits of scholarly activities in research and education to make an international impact. The school has also initiated Post-Doctoral research program and currently four Post-Doctoral fellows are working at this school. The faulty members of the school are closely working with the engineering colleagues on different research projects .The school has procured state-of-art equipments to pursue advanced research. The course "Physics behind computer" a unique course was introduced during this year to open up to the engineering students a new window of looking into 'Physics', working inside computer.

## Faculty

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# Post Doctoral Fellows

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## Developmental Projects

| S.No | Project | Sponsoring agency | Investigators | Project cost(in lac) |
|---|---|---|---|---|
| 1 | Establishment and Maintenance of Science Laboratories<br><br>Date of sanction: 12.02.2011<br>Date of completion:11.02.2013 | IIT Mandi | Subrata Ghosh, Prem Felix siril, Suman Kalyan Pal | 5,28,000 |

## Research Projects

| | Project | Sponsoring agency | Investigators | Project cost (in lac) |
|---|---|---|---|---|
| 1 | Nonlinear Delay and Functional Differential Equations with Applications<br><br>Date of sanction: 28.03.2011<br>Date of completion: 27.03.2014 | IIT Mandi | Syed Abbas | 2,60,000 |
| 2 | Photoabsorption Studies on Atomic Systems<br><br>Date of sanction: 19.04.2011<br>Date of completion: 18.04.2014 | IIT Mandi | Hari Varma | 3,20,000 |
| 3 | DNA aptamer conjugated gold nanoparticles for targeting cancer cells | IIT Mandi | Chayan K. Nandi | 4,97,588 |
| 4 | Photoinduced Electron Transfer in Organic moleculeInorganic Nanomaterial Hybrid Systems<br><br>Date of sanction: 06.05.2011<br>Date of completion: 05.05.2014 | IIT Mandi | Suman Kalyan Pal | 4,85,000 |
| 5 | Development of Noble Metals containing Polyoxometalates for Structural Studies and Catalytic Applications<br><br>Date of sanction: 06.05.2011<br>Date of completion: 05.05.2014 | IIT Mandi | Pradeep C. Parameshwaran | 5,50,000 |
| 6 | Synthesis of Novel cyclophanes and its Application in the Synthesis of Transition Metal Complexes<br><br>Date of sanction: 06.05.2011<br>Date of completion: 05.05.2014 | IIT Mandi | P. C. Ravikumar | 5,00,000 |

| 7 | Exploration of swollen liquid crystal templates for structured nanomaterial synthesis<br><br>Date of sanction: 19.05.2011<br>Date of completion: 18.05.2014 | IIT Mandi | Prem Felix Siril | 5,00,000 |
|---|---|---|---|---|
| 8 | Modeling the Spread and Control of Epidemics with Reaction Diffusion Systems<br><br>Date of sanction: 26.05.2011<br>Date of completion: 25.05.2014 | IIT Mandi | Nitu Kumari | 5,00,000 |
| 9 | Higher Order Compact (HOC) finite difference scheme for Immersed Interface Problems<br><br>Date of sanction: 26.05.2011<br>Date of completion: 25.05.2014 | IIT Mandi | Rajendra K. Ray | 5,00,000 |
| 10 | Novel highly conjugated molecules: Design, synthesis, characterization, photophysical and theoretical studies<br><br>Date of sanction: 14.06.2011<br>Date of completion: 13.06.2014 | IIT Mandi | Subrata Ghosh | 5,00,000 |
| 11 | Nanophotonic systems for quantum information processing and coherent control<br><br>Date of sanction: 27.06.2012<br>Date of completion:26.06.2015 | DST | Pradyumna K. Pathak | 13,44,000 |
| 12 | Cavity quantum electrodynamics in solid-state systems<br><br>Date of sanction: 11.07.2011<br>Date of completion: 10.07.2014 | IIT Mandi | Pradyumna K. Pathak | 5,00,000 |
| 13 | Structural and electronic structure studies of different transition metal oxides<br><br>Date of sanction: 14.07.2011<br>Date of completion: 13.07.2014 | IIT Mandi | Bindu Radhamany | 5,00,000 |

| 14 | Dynamical Analysis of Highly excited molecular spectra<br><br>Date of sanction: 08.09.2011<br>Date of completion: 07.09.2014 | IIT Mandi | Aniruddha Chakraborty | 4,70,000 |
|---|---|---|---|---|
| 15 | Design and analysis of Heuristic Search Techniques for Global Optimization<br><br>Date of sanction: 19.03.2012<br>Date of completion: 18.03.2015 | IIT Mandi | Manoj Thakur | 4,70,000 |
| 16 | Study on microscopic origin of glass transition in biopolymers<br><br>Date of sanction: 19.03.2012<br>Date of completion: 18.03.2015 | IIT Mandi | Prasant P. Jose | 5,00,000 |
| 17 | Chiral Metal – Organic Frameworks : Rational Synthesis, Characterization and Novel Applications<br><br>Date of sanction: 05.09.2011<br>Date of completion: 04.09.2014 | DST | Rik Rani Koner | 25,75,000 |
| 18 | Swollen liquid crystal soft templates for structured nanomaterial synthesis<br><br>Date of sanction: 13.07.2011<br>Date of completion: 12.07.2014 | DST | Prem Felix Siril | 19,25,000 |
| 19 | Collision Processes in Atomic and Molecular Physics<br><br>Date of sanction: 04.09.2012<br>Date of completion: 03.09.2015 | DST | Hari R. Varma, PC Deshmukh | 10,62,000 |
| 20 | Towards Novel Barbiturates as Matrix Metalloprotenase (MMP) Inhibitors: Design, Synthesis, Characterization and Biological Evaluation<br><br>Date of sanction: 01.08.2012<br>Date of completion: 31.07.2015 | DST | Subrata Ghosh | 22,85,000 |
| 21 | DNA aptamer conjugated gold nanoparticle for targeting cancer cells<br><br>Date of sanction: 01.08.2012<br>Date of completion: 31.07.2014 | DST | ChayanKanti Nandi | 22,80,000 |

| 22 | Molecular Chaperone's mediated protein folding using time resolved single molecule Forster resonance energy transfer<br><br>Date of sanction: 30.12.2013<br>Date of completion: 29.12.2016 | DBT | Chayan Kanti Nandi | 70,00,000 |
|----|----|----|----|----|
| 23 | Super molecular High Energy Compounds synthesis, Characterization and theoretical Studies<br><br>Date of sanction: 27.07.2012<br>Date of completion: 26.07.2015 | DRDO | Subrata Ghosh Prem Felix, A.Chakraborthy | 36,04,500 |
| 25 | Development of Polyoxometalates organic Hybrids having through-bond Electronic interactions between cluster and organic units for materials And catalytic applications<br><br>Date of sanction: 10.05.2012<br>Date of completion: 09.05.2015 | DST | Pradeep C. Parameswaran | 26,90,000 |
| 26 | Resists Concepts for EUVL at the 16 nm Node and Beyond<br><br>Date of sanction: 01.07.2012<br>Date of completion: 30.06.2015 | INTEL | Kenneth Gonsalves, P.Parameswaran S. Ghosh, TA Gonsalves, Satinder Sharma | $3,51,000/- |
| 27 | A Short Formal Asymmetric Synthetic Approach to Huperzine-A<br><br>Date of sanction: 15.06.2012<br>Date of completion: 14.06.2015 | DST | P. C. Ravi Kumar | 27,00,000 |
| 28 | Controlled Fabrication of Realistic Nano-circuits using Robust Artificial Peptides<br><br>Date of sanction: 11.04.2012<br>Date of completion: 10.04.2017 | DST | Venkata Krishnan | 35,00,000 |
| 29 | Engineering Molecular Organic Frameworks Crystal Structure and Photo Physical properties<br><br>Date of sanction: 19.03.2012<br>Date of completion: 18.03.2017 | DST | Abhimanew Dhir | 35,00,000 |

| 30 | Exploring the Human Microbiome: A Hunt for the candidates for Pre- and Pro-biotics<br><br>Date of sanction: 18.07.2012<br>Date of completion: 17.07.2017 | Ramalingaswami Re-entry Fellowship DBT | Tulika Srivastava | 19,90,000 |
|---|---|---|---|---|
| 31 | Novel Routes for Crystallization Of Energetic Compounds<br>Periodicity &a Almost Periodicity in Ecological Modeling<br><br>Date of sanction: 16.01.2013<br>Date of completion: 16.01.2016 | DRDO | Prem Felix Siril, Prasanth P. Jose | 68,48,250 |
| 32 | Periodicity &a Almost Periodicity in Ecological Modeling<br><br>Date of sanction: 15.11.2012<br>Date of completion: 14.11.2015 | NHBM, DAE | Syed Abbas | 8,57,500 |

## Progress of the Research Projects

**Nonlinear delay and functional differential equations with applications**
**Syed Abbas**

The major objective of this study has been to investigate the dynamic behavior of delay / functional differential equations and their applications in various fields like neural networks and ecological modeling. The main aim of this project has been to analyze the concepts like existence, uniqueness and some qualitative behavior of the solutions of differential equations. In the first year, existence of pseudo almost automorphic solutions of integro-differential equations was investigated. This work has been published in a reputed Journal "Computer and Mathematics with Applications" published by Elsevier science. After finalizing this work application of delay differential equations in the field of neural network modeling was studied. For that a model of cellular neural network with delay was taken. After analyzing the existence and of the solutions, we established the global attractivity by using suitable Lyapunov function. In our knowledge, this is the first paper to analyze the almost automorphic solutions of neural networks. The work has been published in the Journal "ActaMathemeticaScientia" published by Elsevier. After completion of the neural network work, we did a fundamental work, in which we considered fractional impulsive differential equations and analyzed the existence, uniqueness and stability of the system. This work has been published in "Int J of Diff Eqns". Fractional differential equations are very important class of differential equations and havereceived much attention in the recent years. Many Mathematicians and Scientists are generalizing various results of ordinary differential equations for partial differential equations and sometime it gives better approximate result than usual directive. These observations suggest that area of abstract, delay and functional differential equations is very vast and have excellent applications in many fields. Also it is more difficult to analyze than ordinary differential equation because of discontinuity. We are still working on both theoretical and application aspect of these general classes of differential equations.

**Photoabsorption studies on atomic systems**
**Hari Varma R.**

Time-delay associated with the ejection of photoelectrons with respect to the instant at which lightpulse is incident on the absorbing atom can nowbe measured using recent developmentsinattosecondstreaking.Anumberofexperimentalandtheoreticalstudieshavealreadyb eenreported.Westudiedthe time-delay in the ionization of Xe which is trapped inside a fullerene molecule(Xe@C60) to understand the role of confinement on the photo ionization emission. RelativisticRandom Phase approximation was used to obtain the phase shifts and the time-delay was calculatedusing the Wigner's relation connecting phase-shift and time-delay.  We found that time-delay changes very dramatically near Cooper minimum. Further, the presence of confinement oscillationsbrings contributes to the additional delay in photoemission. Besides we also studied the autoionization resonances regions in several atomic systems. Theseresonances structures results from the interference of ionization channels with the excitationchannels resulting in dramatic variations in the photoionization parameters. We studiedautoionization resonances in 5d5/2 photoionization parameters of atomic Hg. The resonances weredueto the interference of 5d5/2 ionization channels with excitation channels from 5d3/2subshells. Weemployed relativistic random phase approximation (RRPA) to obtain preliminary information aboutthe resonance region. A detailed study of resonance was carried out using relativistic multi-channelquantum defect theory (RMQDT). Our studies found a reasonable agreement with the otherexperimental results. Several other isoelectronic/isonulcear series studies are in progress to identifyresonances in the region of 6.X nm which has potential applications in the field of lithography.

**Photoinduced electron transfer in organic molecule-inorganic nanomaterial hybrid systems**
**Suman Kalyan Pal**

Inorganic nanomaterials e.g. zinc oxide (ZnO) nanocrystals (NCs) and nanoroads (NRs) were synthesized via chemical methods. The synthesized nanomaterials were characterized by UV-Vis absorption and transmission electron microscopy (TEM). The size of the NCs as obtained from TEM measurement is 3.5 nm and that for NRs, diameter 30 nm and length 100 nm.  Photoinduced interaction between ZnO NCs and Rhodamine B (RhB) molecule has been investigated by steady state and time-resolved emission measurements. The visible emission of ZnO NCs was quenched as a result of fluorescence resonance energy transfer from NCs to RhB molecules. The most importantly, this study reveal that at least three decoupled defect transitions which are associated with the visible emission of ZnO NCs interact individually with the dye molecule resulting in wavelength dependent energy transfer and hence uneven quenching of the NC fluorescence. Investigation on the excited state interaction of ZnO NRs with organic molecule is underway. In order to study the photoinduced interaction between core/shell nanoparticles and organic molecules, ZnO core and graphene shell nanoparticle has already been synthesized and characterized. Due to non availability of femtosecond pump-probe the completion of this project may be delayed by a year.

**Development of noble metals containing polyoxometalates (*poms*) for structural studies and catalytic applications**
**Pradeep C. Parameshwaran**

Anionic metal oxide clusters called polyoxometalates (POMs), made up of early transition metals such as W, Mo, V, Nb and Ta, are well known for their interesting structural features and properties. Noble metals Pd, Pt, Au etc are rarely incorporated into such Polyoxometalates framework. Because of the relevance of noble metals in catalysis and device fabrication, the synthesis and structural characterization of their polyoxometalate analogues will be a rewarding but challenging task.In the present project, attempts are being made to synthesize new polyoxometalate clusters especially those incorporating some noble metals. Using the seed grant amount, basic synthetic infrastructure required for the project has been set up. Various precursor POM clusters have been synthesized and characterized that include lacunay POM clusters like $[SiW_9O_{34}]^{10-}$, $[SiW_{10}O_{36}]^{8-}$, $[PW_9O_{34}]^{9-}$, $[PW_{10}O_{36}]^{7-}$, $[P_2W_{17}O_{61}]^{10-}$, $[P_2W_{15}O_{56}]^{12-}$, $[H_2P_2W_{12}O_{48}]^{12-}$ etc. Experiments are in progress to combine these lacunary POMs with various noble metal ions to get the proposed noble metal containing POMs.

**Exploration of swollen liquid crystal templates for structured nanomaterial synthesis**
**Prem Felix Siril**

SLC has been used to prepare nanostructures of noble metals, conducting polymers, composites of conducting polymers with noble metals and organic nanoparticles. The underlying experimental variants that control such nanostructure formation have been studied in detail. This we could prepare zero-dimensional and one-dimensional nanostructures by adjusting the condition of synthesis. Zero dimensional nanostructures were formed when the oxidizing agent was mixed with the monomer containing SLC thoroughly. This perhaps induces random nucleation throughout the mesophases and growth around these nuclei lead to 0-D nanostructures. However, slow addition of the oxidizing agent on to the top surface of the mesophase allows slow diffusion of the oxidizing agent. Nucleation happens only at the initial point of contact between the oxidizing agent and the mesophases. Growth of these nuclei occurs progressively along the vertical direction along the axis of the surfactant cylinders.This lead to the formation of one-dimensionalnanostructures. Confining the monomer and the initiator within the mesophases and then adding one of them on the top surface of the other also gave 1-D nanostructures.

**Higher Order Compact (HOC) finite difference scheme for immersed interface problems**
**Rajendra K. Ray**

We are working on the development of higher order accurate numericalscheme to solve the interface problems by clubbing HOC methodology withspecial interface treatment for problems having discontinuities along theinterfaces. This type of problem arises quite frequently in the field ofscience and engineering. It includes biochemical processing, solidmechanics, porous media flow, heat transfer, multiphase flow, mining andmany others. After its successful development, we shall apply this schemeto solve flow past circular cylinder problem (which produces almost alltypes of fluid phenomena) to test its potential impacts on flowvisualization and robustness of the scheme. During last one year we havedeveloped a new methodology for numerically solving elliptic

equations with discontinuous coefficients and singular source terms. This new scheme is obtained by clubbing a recently developed Higher Order Compact (HOC)methodology with special interface treatment for the points just next to the points of discontinuity. We first formulated the scheme for two-dimensional (2D) problems in polar coordinates. In the process, we also performed convergence and related analysis for this scheme. Finally, we showed a new direction of implementing the methodology to 2D problems

in Cartesian coordinates. We then conducted numerous numerical studies on a number of problems, both in 2D polar and Cartesian coordinates, and compared our results with those obtained with immersed interface and other well-known methods. In all the cases our formulation was found to produce better results on relatively coarser grids. By judiciously choosing the intensity of clustering around the points of discontinuity, which is very simple to implement in actual programming, one can minimize the overall error in computing. It also has the advantage that the finite difference formulas at irregular points are derived in an explicit form so that they can be easily applied to different problems with minor modifications. One of the main motivations for developing our 2D polar scheme has been itsstraight forward implementation to flow past a circular cylinder problem, whereas the Cartesian formulation is much more flexible, as it is equipped

to tackle situations where the interface is arbitrarily shaped. Currently, we are working on the extension of the proposed schemes to problemsinvolving fixed/moving interfaces and rigid boundaries involving irregulardomains and its application to flow past circular cylinder problems.

**Novel highly conjugated molecules: Design, synthesis, characterization, photophysical and theoretical studies**
**Subrata Ghosh**

We already have developed few conjugated molecules and their application in detecting environmentally and biologically importnat metal ions has been demonstrated. Our experimental results have been supported by the theoretical studies. With the help of the financial support received from this project grant, four research papers have been published in the international journals of repute. Brief description of each work is as follows:

A carbazole-based Schiff base **1**, synthesized in two steps, was found to be a fluorescence chemosensor for selective detection of $Fe^{3+}/Cu^{2+}$ratiometrically over a wide spectrum of metal ions quite efficiently. The carboxylated unit, 'CH$_2$COOH', acts as a 'locking unit' restricting the possibility of E/Z isomerization and ESPT. This has been supported by the theoretical studies. The selectivity
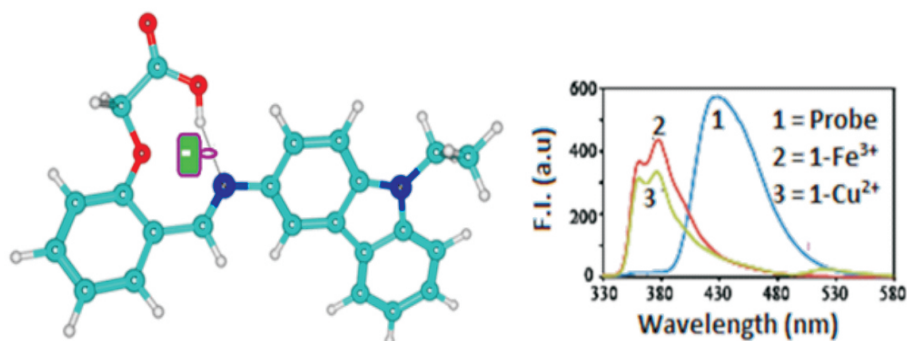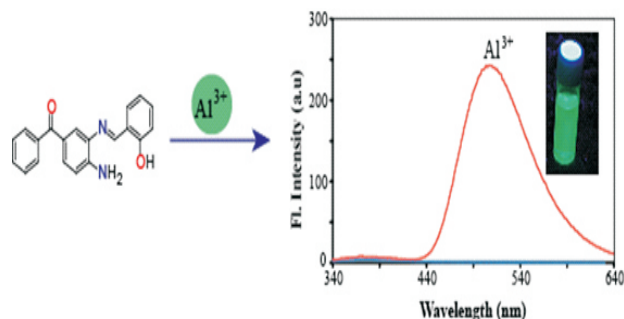
was established using various spectroscopic techniques like UV-vis and fluorescence spectroscopy. The probe was found to have fluorescence property with quantum yield 0.18.The binding of this fluorescent receptor with metal ions was also proved by NMR and mass spectrometry. The present probe can efficiently detect the presence of very low concentration of $Fe^{3+}/Cu^{2+}$ (0.51 and 4.46 μM of $Cu^{2+}$ and $Fe^{3+}$ respectively). Interestingly, the minimum concentration of $Cu^{2+}$ which can be detected by this probe is much less than the average concentration of copper in the blood (15.7-23.6 μM).

A benzo[*h*]chromene derivative, 2-amino-4-phenyl-4H-benzo[*h*]chromene-3-carbonitrile **1**, has been utilized as 'Turn On' fluorescence chemosensor for the selective detection of $Pb^{2+}$. The title compound **1** was synthesized in one step using a multicomponent condensation reaction (MCR), and characterized using various spectroscopic techniques. The selectivity was tested over a range of seventeen different metal and non-metal ions. Compound **1** was found to be weak fluorescent ($\varphi_1$ = 0.06) because of photoinduced electron transfer (PET). The presence of 2 equiv of $Pb^{2+}$ showed a significant increase in fluorescence quantum yield ($\varphi_{1-Pb}^{2+}$ = 0.132). A change in weak blue emission of **1** to a glowing green emission along with a prominent red shift (26 nm) in emission band was observed upon addition of $Pb^{2+}$ to a methanolic solution of **1**. The complexation of **1** with $Pb^{2+}$ was proved by mass spectroscopy and NMR studies. Some of our experimental findings have been supported by theoretical studies. Compound **1** was found to be easily permeable to living cells without causing any harm and ultimately was used to detect effectively $Pb^{2+}$ in living system.

Graphenequantum dots (GQDs) have successfully been utilized as efficient nanosized fluorescence chemosensor to detect selectively $Hg^{2+}$ in 100% aqueous solution (pH7). The selectivity and sensitivity of the probe has been investigated by employing a number of spectroscopic techniques. The probe follows a'turn-off' mechanism while sensing the highly toxic pollutant $Hg^{2+}$. Steady state and time- resolved spectroscopic studies ensure that the adsorption of $Hg^{2+}$ onto the surface of GQDs leads to the change in electronic structure of the probe which ultimately results in the quenching of fluorescence of GQDs. The capability of GQDs to detect $Hg^{2+}$ under physiological conditions makes them interesting and useful sensing devices for biological applications.

A benzophenone-based Schiff base 1 has been utilized as fluorescence chemosensor for selective detection of $Al^{3+}$. The probe was synthesized in one step, and found to be non-fluorescent due to a combination of photoinduced electron transfer (PET), excited state intramolecular proton transfer (ESIPT) and E/Z isomerism. Upon addition of $Al^{3+}$ into a methanolic solution of 1, development of strong fluorescence signal was observed with an attractive glowing green emission. This was due to inhibition of PET, ESIPT and E/Z isomerism, and activation of chelation enhanced fluorescence



(CHEF). The quantum yield of 1-$Al^{3+}$ was found to be 0.17. The selectivity was tested over 24 different metal and non-metal ions, and established using various spectroscopic tools. The strong affinity of compound 1 for $Al^{3+}$ was also proved by ^{1}H NMR and mass spectroscopy.

## Nanophotonic systems for quantum information processing and coherent control
**Pradyumna Pathak**

The literature survey in the last few months relevant to the project has been done and techniques and methods have been developed required to work on the project. Control of light by using light has been achieved in nonlinear optical systems for example electromagnetically induced transparency (EIT), where transmission of light in optically dense medium is manipulated by using a control laser. Such experiments scaled at one particle level like photon or single quantum dot will allow implementation of logics for quantum computation. We have found that transmission of light can be controlled by a single dot coupled in a cavity. We are also working to find the effects of decoherence on EIT for a single quantum dot. In quantum dots there are many processss leading to large decoherence.We are also in the process of developing numerical simulations and Green's function techniques for coupled photonic systems like coupled systems of waveguides, cavities and quantum dots. These studies are most important for development of chip-based photonic technology.

## Dynamical analysis of highly excited molecular spectra
**Aniruddha Chakraborty**

Understanding dynamics of highly excited vibrational motion of small molecules is one of the most important challenges in this area. The aim of this research has been to extract new understanding about dynamics from the information present in the experimental spectra and to apply this knowledge to understand internal molecular energy flow and reaction dynamics.

In highly excited vibrational states of molecules, strong mode coupling and an-harmonicity give rise to complicated classical dynamics, making the simple normal mode analysis unsatisfactory. Traditional methods for analysing the spectrum are based on assignment of eigenstates in terms of quantum numbers (zero order), such as number of quanta in each normal mode, which can be physically meaningful only at low energy, near harmonic regime. In highly excited vibrational spectra these zero order quantum numbers are destroyed by the strongly coupled dynamics, which means the spectra become un-assignable in ordinary terms.Effective spectroscopic Hamiltonians are very useful to analyse and extract information from experimental and simulated spectra. We are using our methods to interpret experiments that probe molecules via the high resolution frequency-domain spectra. We started working ongeneralized effective spectroscopic Hamiltonian by fitting the spectrum of real an-harmonic systems using simulated data. Once we get positive results, we will start working on with real data (from our research collaborator R. W. Field @ MIT). The standard approach for building an effective spectroscopic Hamiltonian is well understood for systems below the dissociation energy of any bond. We plan to extend our method to energies above the dissociation energy of any bond. This is non-trivial because one has to incorporate the effect of energy continuum into the energy levels, which is one of the key challenges in this area.

## Structural and electronic structure studies of different transition metal oxides
**Bindu Radhamany**

A furnace which can withstand a temperature of about $950^{\mathring{a}}C$ has been fabricated. This furnace is

used for the purpose of calcination to prepare transition metaloxides. We have successfully prepared large bandwidth manganite namelyLa$_{0.2}$Sr$_{0.8}$MnO$_3$.The preliminary structural and magnetic characterization indicates thatthe samples are single phase. Using this sample we have performed high resolution x-raydiffraction experiments at ESRF, France; neutron diffraction experiments at ILL, France and inverse photoemission (IPS) experiments at UGC-DAE CSR. The dataobtained from ESRF, France were analysed and the results were published in Phys. Rev.B (Rapid Comm.). The results obtained from IPS are in the manuscript writing stage. Theanalysis of the data obtained from ILL, France is in progress. The trip to photon factory, KEK, Japan for performing xrd experiments were funded by DST. The results of this data are also under analysis.

## Design and analysis of heuristic search techniques for global optimization
**Manoj Thakur**

Many real life problems can be modeled as nonlinear optimization problems involving one or more decision variables. The problem of locating the global minimum/maximum of a multimodal function come across in many fields such as Mechanical, Electrical, Aerospace engineering etc. Moreover many optimization problems in science and engineering involve constraints also. Generally in the presence of constraints search space of the problem reduces and finding the optimal solution becomes difficult. Without loss of generality, a general nonlinear programming (NLP) problem can be stated as )(*xf Min, whereR f: R$_n$®,

*Where Sx*ÍWÎ*, and S is an n-dimensional rectangular hypercube in $_n$R identified by , n, , ,    , I  b  x*
*a$_{iii}$*¼=££*321. These are often called bounds on the decision variables.*

The feasible region *S*ÍW*is* defined by a set of *m*nonlinear inequality and *p* nonlinear equality constraints:

, *m*, , , *k  xg$_k$*¼=³3210)(,, *p*, , , ,*j  xh$_j$*¼==3210)(

During the period under report an efficient algorithm for optimization technique for unconstrained global optimization has been developed. The accuracy and reliability of this algorithm is being tested on the test suite of benchmark problems collected from literature.The initial results of the algorithm are encouraging. These findings are being extended to solve constrained optimization problems and discrete and mixed discrete-continuous optimizationproblems.

## Chiral metal-organic frameworks: rational synthesis, characterization and novel Applications
**Rik Rani  Koner**

One of the major aim of this project is to develop aminoacid-based fluorescent probes which can easily interact with metal ions and render fluorescence signalling. We recently have synthesized one such molecular probe and shown its practical application.

Quencher displacement strategy for recognition of trivalent cations through 'turn-on' fluorescence signaling of an amino acid hybrid was used.An in situ generated anthracene based hybrid amino acid **1**–Cu$^{2+}$ complex has been utilized efficiently as a light-up probe to detect biologically/environmentally important trivalent metal ions Fe$^{3+}$/Cr$^{3+}$/Al$^{3+}$through turn-on

fluorescence signaling. Whereas the amino acid derivative **1** showed a poor selectivity toward various metal ions, the **1**–$Cu^{2+}$ ensemble showed a high selectivity toward trivalent cations.The enhancement in fluorescent intensity of **1**–$Cu^{2+}$ was due to the displacement of $Cu^{2+}$ from **1**–$Cu^{2+}$ by $Fe^{3+}/Cr^{3+}/Al^{3+}$. Interestingly, the displacement of a paramagnetic ion ($Cu^{2+}$) by other paramagnetic ions ($Fe^{3+}/Cr^{3+}$) resulted in an increase in fluorescence intensity by many folds. The selectivity was established in the presence of a large number of different metal ions using various spectroscopic techniques. This **1**–$Cu^{2+}$ ensemble was also found to be a selective sensor for phosphate anion.
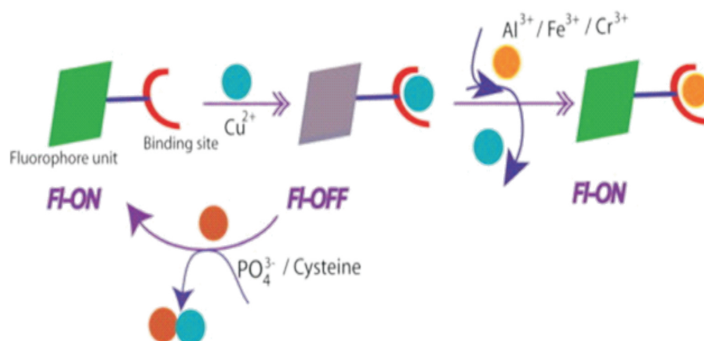


**Synthesis of novel cyclophanes and its application in the synthesis of transition metal complexes**
**P.C. Ravikumar**

Cyclophanes are cyclic organic molecules with at least one aromatic ring embedded as a part of the cyclic ring in other words any aromatic ring bridged by at least one aliphatic n-membered bridge with n ⬚ 2 is termed as a cyclophane. Cyclophanes are also called as supramolecules, one of the most characteristic feature of supramolecular chemistry is that it gives information about inter and intra molecular interactions.Cyclophane synthesis involves the closure of medium to large sized rings and is therefore always difficult because of competing polymerization reactions.We have envisioned to synthesize the cyclophanes by a novel NbCl5 based rearrangement and alkylation reaction sequence. So far we were able to synthesize precursors, optimization of cyclisation reaction is currently underway. After establishing the cyclization strategy we will utilize the same route to obtain the number of structurally diverse cyclophanes, which could then be used to complex with transition metals such as Pd, Pt, Nb, W, Ru and Rh to study its structural properties.

**Swollen liquid crystal 'soft' templates for structured nanomaterial synthesis**
**Prem Felix Siril**

Swollen liquid crystals (SLCs) are a class of lyotropic liquid crystals where the aspects of the liquid crystalline assembly can be tuned by varying the composition. We have employed SLCs to prepare nanostructures of noble metals such as Pd and Au using chemical reduction methods. The Pd precursor salts were dissolved in oil phases of SLCs while the gold precursor was dissolved in aqueous phase. The mesophases were synthesized using the method described above. For the synthesis of noble metal nanostructures the mesophases containing metal precursor was reduced by reducing agents such as monohydrate hydrazine or hydrogen. The reduced metal nanostructures were then extracted via centrifugation and subsequent washing with isopropyl alcohol. Thorough characterization of these materials has been done using various advanced characterization techniques. We obtained Pd nanowires of high aspect ratio and uniform diameter.

We have also prepared nanostructures of polyaniline and its composites with noble metals using SLC templates. Mesophases containing aniline in the oil phase of SLCs were prepared by replacing a part of the oil phase with aniline. We used aniline hydrochloride as the saltd medium to prepare SLCs containing aniline in the aqueous phase. We could obtain 0-D and 1-D polyaniline nanostructures by tuning the way ammonium persulphate (oxidizer) is mixed with aniline containing mesophases. Zero dimensional PANI nanostructures were obtained by thorough mechanical agitation after addition of APS to the mesophases. Whereas one dimensional nanostructures were produced by adding APS on to the top surface of the mesophase and allowing the reaction to progress through slow diffusion of APS. The prepared nanostructures were thoroughly characterised using a number of techniques. Polyaniline nanostructures showed enhanced sensitivity compared to bulk polyaniline for amperometric electrochemical detection of glucose.

Polyaniline-Au and Polyaniline-Pdnanocomposites were also made by mixing the aniline containing mesophases with the metal salt containing mesophases. Gold nanocables with polyanilinine sheathing were prepared and were found to show enhanced catalytic activity for dye reduction.

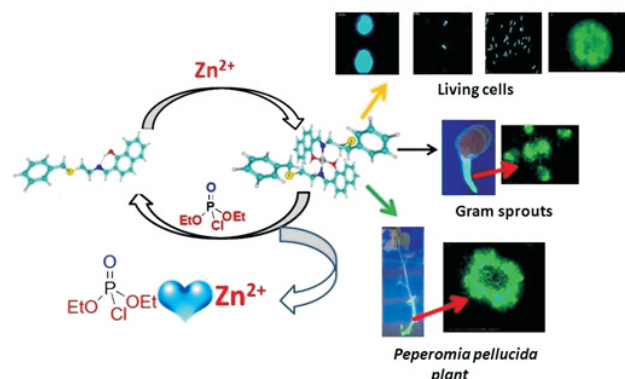**Collision processes in atomic and molecular physics**
**Hari Varma R.**

Photoionization studies of atoms trapped in fullerene (A@$C_{60}$) cages have attracted considerable attention in the recent past owing to their importance many area of physics. The external potential causes significant changes in atomic ionization probabilities by inducing confinement oscillations in the photoionization parameters. The existence of such oscillations in Xe@$C_{60}$ has been verified in a recent experiment elsewhere. These developments motivated us to study different confined systems to study the role of correlation and relativistic effects in it. Fullerene potential is simulated by using a spherical shell potential. In the present work, Relativistic Random Phase approximation (RRPA) method is employed to determine the photoionization parameters. We studied the photoionization of Cd which is trapped inside a fullerene molecule (Cd@$C_{60}$) to understand the combined effect of confinement, correlation and relativistic effects in such endohedral system. The present work showed the existence of correlation induced Cooper minimum and correlation induced confinement oscillations in the photoionization parameters. We also considered several high-Z atoms trapped inside the fullerene cage such as Radon (Z=86) and Radium(Z=88) to sudy the combined effects correlation, confinement and relativistic effects on various features observed, in an earlier work, in the photoionization parameters of free Radon and Radium. Our studies showed the importance of models which includes the relativisitic effect, confinement and correlation effects to have a complete description of the system. We also studied the effect of non-dipole interactions in confined systems. For this we considered Mg@$C_{60}$ and found that confinement accentuates the non-dipole interactions and makes quadrupole cross-section larger than dipole cross-section near the region of Cooper minimum about photon energy of 17 eV. As a result dramatic changes in the angular distribution of 3s electrons are observed. At present we are trying to model the fullerene more effectively so that effect of fullerene electrons can be accounted while describing the ionization processes.

**Towards novel barbiturates as matrix metalloprotenase (MMP) inhibitors: design, synthesis, characterization and biological evaluation**
**Subrata Ghosh**

The aim of this project has been to develop barbiturate-based small molecules having zinc-binding sites and applications of these molecules as inhibitors of Matrix Metalloprotenase (MMP). The financial sanction for this project was received in October, 2012. The procurement of necessary chemicals and instruments has been completed. One junior research fellow has been appointed who is working on this project. We have started synthesizing the proposed molecules and are about to complete the synthesis of first molecule. In the mean time, and with these financial aids, we have developed few molecular probes which have been successfully utilized in imaging zinc in biological systems starting from anilas to plants. We also have demonstrated an easy and inexpensive method for checking the biostability of a newly developed probe and its real-time analysis potential. These works are under review now.

**DNA aptamer conjugated gold nanoparticles for targeting cancer cells**
**Chayan Kanti Nandi**

Using aptamer-conjugated gold nanoparticles, the main objective of this research proposal was to understand the selection of effective therapeutic pathways and improve clinical diagnostics particularly critical in the early stages of tumor development in cancer therapy.At a first step, we have synthesized different size and shapes of gold nanoparticlesand checked their optical as well as biological properties when put in the biological media. We checked how the gold nanoparticles are being affected by the serumproteins by forming a protein corona. We also have tried to understand the role of conformational topologies of differentDNAaptamers*in vitro* in the absence of ligand proteins and in different localchemical environment.

**Super molecular high energy compounds synthesis, characterization and theoretical studies**
**Subrata Ghosh**

Our aim was to synthesize energetic compounds with low sensitivity, good thermal stability and high performance. We successfully synthesized five compounds including nitrate esters and polyfluoro compounds. Three of them showed good thermal properties. We have prepared at least 1.0 g of each of these three compounds (e, f & h) and are being sent
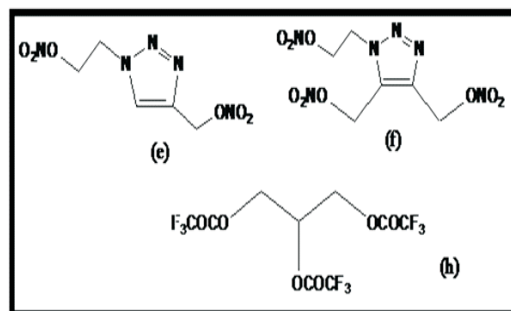
Figure. Chemical structure of three stable energetic compounds

to TBRL, Chandigarh to check their efficacy. All these compounds have been characterized by FT-IR, NMR & TGA-DSC.

**Development of Polyoxometalates-Organic hybrids having 'through-bond' electronic interactions between cluster and organic units for materials and catalytic applications**
**Pradeep C. Parameshwaran**

Polyoxometalates (POMs) are a class of inorganic materials consisting of discrete, soluble, anionic metal-oxide clusters of early transition metals, especially W, Mo, V and Nb, exhibiting enormous versatility in their structural features and properties. POM clusters can accept a number of electrons reversibly without cluster disintegration and can delocalize these electrons over their nanometer sized structures. In addition, certain properties of POM clusters such as their band gap could be easily fine tuned by combining them with suitable organic units.These properties make POM clusters good substitute for traditional aims to utilize POMs as nanosized electron acceptors to generate good donor-acceptor systems by combining them with photo-excitable organic sensitizer groups so that the resulting POM-organic hybrids could be useful as photocatalysts as well as components in solar cells. Towards this aim, various organic sensitizer units such as dyes, flavins, fullerenes etc can be attached to suitable POM clusters through new linker units that are capable of allowing 'through bond' electronic interactions between organic units and inorganic cluster. These new materials are expected to be useful for their structural, supramolecular, light harvesting and photocatalytic properties. Synthesis of various POM clusters and organic units have been completed. Further studies are in progress.

**Resists Concepts for EUVL at the 16 nm node and beyond**
**Kenneth Gonsalves, P. Parameswaran, S. Ghosh, T A Gonsalves, Satinder Sharma**

A novel non-chemically amplified negative photoresist was synthesized and characterized for next generation lithography applications and shown to be directly sensitive to radiation without utilizing the concept of chemical amplification (CARs). This resist design is accomplished by copolymers that are prepared from monomers containing sulfonium groups which are sensitive to e-beam irradiation and would therefore be useful for EUVL down to the 16 nm node and below. Less than 20 keV e-beam imaging and TMAH development, a sensitivity of 35 μC/cm$^2$ and contrast of 2 were obtained. LER of 20 nm, 10 lines pattern varies from 1.8±0.3 to 2.3±0.4 nm.



20 nm line pattern at a
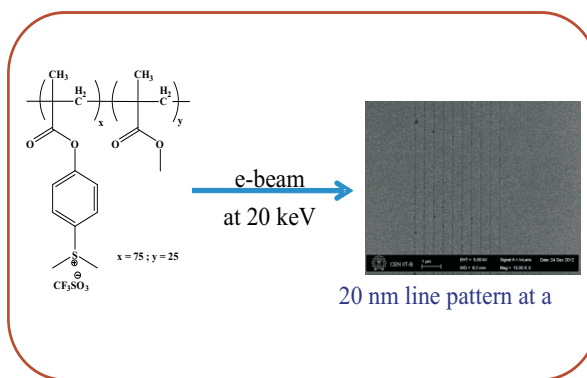
## A short formal asymmetric synthetic approach to huperzine-A
### P.C. Ravikumar

Alzheimer's disease is a common neurodegenerative disorder that affects mostly aged people and has already afflicted an estimated 20 million people worldwide.[1] Alzheimer's disease leads to progressive loss in cognitive abilities, performance of routine tasks, time and space orientation, communication skills, abstract thinking, and personality. The life expectancy of individual affected by Alzheimer's disease is about eight years starting from diagnosis until death.

Huperzine A (Figure 1) **1** is an alkaloid from the *clubmossHuperziaserrata* (Thunb.) Trev) *Lycopodiumserratum*Thunb., whichis used in the treatment of Alzheimer's disease. Under the name Chien Tseng Ta, *H. serrata* has been used in Chinese traditional medicine to treat several ailments. Pharmacological studies of the late 1980s proved Huperzine A**1** to be a very potent inhibitor of the enzyme acetylcholinesterase. Double-blind, placebo-controlled clinical trials were performed on patients suffering from Alzheimer's disease using purified Huperzine A **1** isolated from clubmoss in China. Significant improvements were noted in patients in terms of both life quality and memory retrieval. Huperzine A**1** has been approved and clinically used as a palliative agent for Alzheimer disease in china. Huperzine A**1** has also got the potential to become a dietary supplement in USA.
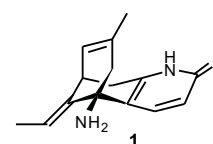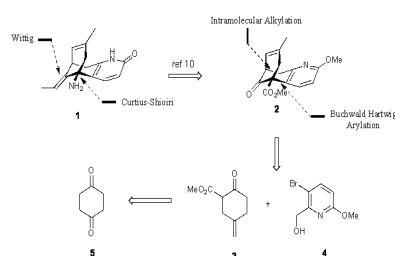


Fig 1. Huperzine A



We have planned to do the synthesis of Huperzine A by a short flexible approach as outlined in Scheme 1

At the moment we are exploring various conditions to install the first quaternary center by using Buchwald Hartwigarylation reaction.

## Controlled fabrication of realistic nano-circuits using robust artificial peptides
### Venkata Krishnan

This project deals with the physico-chemical understanding, design and fabrication of bio-inspired materials. The main goal of this project has been explore the use of molecules, methods and concepts of biology to design and create novel materials with new functions and properties. In particular, the project is aimed at fabricatingnanomaterials in desired structures by controlling the assembly of nanoparticles based on the approaches adopted by nature, particularly biomolecule-directed-assembly, wherein achieving nanoscale structural control will enable the preparation of ordered hierarchical nanostructures in one, two and three dimensions, which could be used for a molecular electronics applications. In the past one year, several organometallic complexes (with different metals and ligands) with donor-acceptor groups suitable for charge transfer applications, to be utilized for molecular electronics were synthesized and characterized using varied spectroscopic techniques. In addition to the above mentioned application, the utility of the synthesized complexes for other related applications (such as chemosensors, etc.) have also been investigated. It is noteworthy to mention that one of the complexes (copper-pyrene array) has showed maximum affinity for picric acid (an explosive material) and a chemosensor based on this complex for the selective and specific detection of the same can be fabricated.

**Engineering new co-ordination polymers: crystal structure and photo physical properties**
**Abhimanew Dhir**

A coordination polymer is an inorganic or organometallicpolymer structure containing metal cation centers linked by ligands. More formally a coordination polymer is a coordination compound with repeating coordination entities extending in 1, 2, or 3 dimensions. It can also be described as a polymer whose repeat units are coordination complexes. Coordination polymers contain the subclass coordination networks that are coordination compounds extending, through repeating coordination entities in 1 dimension, but with cross-links between two or more individual chains, loops, or spiro-links, or a coordination compound extending through repeating coordination entities in 2 or 3 dimensions.

In our research program, we aimed at development of new co-ordination polymer which could be used as synthetic blood plasma anti-coagulant. A group of pharmaceuticals called anticoagulants which prevent the blood coagulation has been developed as medication for such disorders. Therefore, we synthesized new Cd(II) 3D coordination polymer **1** {[Cd(NDC)(QN)]}$_n$ (figure 1) utilizing 2,6-naphthalenedicarboxylate (NDC) and quinoline (QN) as ligands which showed a good blood plasma anticoagulant activity.[1] The nano-dispersion of co-ordination polymer **1** shows a good anticoagulation activity. Some of the experiments were performed in the clinical laboratory at Mandi.
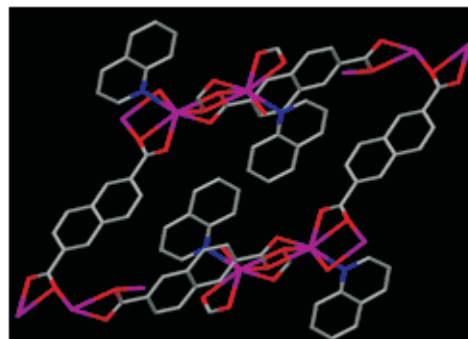
Three dimensional framework of coordination polymer **1**.Colour code: grey colour represents carbon atoms; purplecolour represents cadmium; red colour represents oxygen and blue colour represents nitrogen atoms.

In addition, keeping in view the significance of fluorescence spectroscopy and its application in construction of logic based molecular devices, we also designed and synthesized an another ligand based on melamine containing pyrene as fluorogenic units. The sequential addition of Au$^{3+}$ ions and ascorbic acid to the solution of ligand generates gold micro particles. However, the fluorescence behavior and particle size distribution on sequential additions are different and contributes to the construction of new type of logic based dual channel molecular keypad lock system.[2] Keypad lock is an electronic device which is capable of processing password entries, hence access to an object or data can be restricted to a limited number of people.Further, we designed and synthesized new pyrene based copper complex. The fluorescence behaviour of the complex was studied toward different nitro aromatics and anions. It was observed that copper complex showed maximum affinity for picric acid marked by the changes in the conformation of pyrene in excited state. Applying the principle of electronics, a decision making photonic device can be developed to selectively determine the presence of picric acid.

**Exploring the human microbiome: a hunt for candidates for pre- and pro-biotics.**
**Tulika P. Srivastava**

The endogenous microbial flora plays a fundamentally important role in human health and disease. Recent advancements in metagenomic approaches demonstrated that human body is co-housed

by a community of trillions of diverse microbial species. These microbes perform a variety of useful functions, such as fermenting unused energy substrates, training the immune system, preventing growth of pathogenic bacteria etc. Therefore, some members of the human microbiome have been used as Probiotics for several years, including *Lactobacillus* or *Bifidobacterium.* Our knowledge of the species and functional composition of the human microbiome is rapidly increasing, but it is still based on very few cohorts and little is known about variation across the world. In a recent study, by combining the faecal metagenomes of individuals from four countries, three robust clusters (referred to as enterotypes) have been identified that are not nation or continent specific[8]. These enterotypes are complex and mostly driven by species composition.

Ayurveda is an ancient system of personalized medicine and describes three most contrasting constitution types (*Prakritis*), *Vata*, *Pitta*, and *Kapha*. Individuals from these three constitutional types exhibit striking differences with respect to biochemical and hematological parameters and at genome wide expression levels[9]. Enterotypes appear complex, are probably not driven by nutritional habits and cannot simply be explained by host properties such as age or BMI, although there are functional markers such as genes or modules that correlate remarkably well with individual features. Thus the ancient Ayurvedic concepts may be combined with modern Enterotypes classification systems which will allow us to uncover the microbial species and functional differences which may contribute to the system level differences in normal individuals.

The first objective of this project has been to analyze the 16S ribosomal RNA sequence data from the gut for a representative set of three healthy male individuals, belonging to pure *Prakirti*. Towards this, the 16S ribosomal RNA was isolated from the gut for the individuals belonging to pure *Prakriti* and sequenced using 454 pyrosequencing technologies. The sequence data was obtained and is being analyzed.

The High Performance Computing facility of IIT Mandi has been upgraded by purchasing additional high memory (192 GB, 1TB storage) and lower memory (24 GB, 1TB storage) compute nodes to facilitate the research using the fellowship contingency. Computational lab has been setup by purchasing three powerful desktop computers for routine computational analysis and two high capacity (3TB) external hard drives for regular data backup generated during the project analysis by two PhD research scholars who have joined under my supervision.

I attended the RNA seq 2013 conference which was held in Boston, MA, USA from 19th – 20th June 2013. The conference gathered experts in the field of next-generation sequencing and analysis. The presentations and discussions held were directly related to the analysis of the data generated by the next-generation sequencers. This gave me a great opportunity to learn about the current methods and approaches used in this field which I can now directly apply for the analysis and research in this project. Attending this conference helped me to develop my skills in this area which is highly beneficial for successful implementation of the future phases of this project.

**Novel routes for nanocrystallisation of energetic compounds**
**Prem Felix Siril**

This is an ambitious project to achieve nanocrystallisation of organic energetic compounds using novel methods such as confined crystallization using 'soft' templates and using microfluidics. The

project has been sanctioned very recently and some work background work has already been done. We employed a simple precipitation method for the preparation of nano high energetic compounds (nano-HECs). Rapid injection of a solution of the high energetic compounds such as cyclotrimethylenetrinitramine (RDX) and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) into anti-solvent (water) lead to the precipitation of nanocrystals immediately. We have studied the effect of different parameters on particles size and morphology of these nanocrystals. It was found that the concentration of HEC solution, temperature of antisolvent during injection and nature of the solvent affect the particle size and morphology. Morphology of the particles was characterized using dynamic light scattering (DLS) and field emission scanning electron microscopy (FE-SEM). Crystal structure was identified using powder x-ray diffraction (XRD). Fourier transform infrared (FTIR) spectroscopy was used to characterize the chemical nature of the nano-HECs. Thermal characterization of the nano-HECs was done using simultaneous thermo gravimetric analysis coupled with differential scanning calorimetry (DSC). The mean particles size of the nano-HECs according to FESEM analysis ranged from ~ 40 nm to ~ 230 nm under different conditions of preparation.

## Periodicity & almost periodicity in ecological modeling
**Syed Abbas**

The major objective of this project has been to investigate the periodicity, almost periodicity and quantitative behavior of dynamical systems like ecological modeling, cardiac electrophysiology etc. using ordinary differential equations/partial differential equations/delay differential equations. The study is aimed at to construct ecological models and in these models, analyze the concepts of periodicity, almost periodicity and qualitative behavior of the ecological systems. Literature survey is being carried out on dynamical systems and currently I am focusing on cardiac electrophysiology (modeling on heart). Through literatures it has been observed that efforts are being made in the area of cardiac electrophysiology using delay/differential equations and many models have been developed for example Hodgkin-Huxley model (first quantitative mathematical model of wave propagation in squid nerve), Windkessel model, Hund-Rudy model, Bidomain Model and so on. After completion of the literature survey, data from cardiovascular laboratories or literature will be obtained and efforts will be made to develop a new model and analyze the available behavior of the systems.

## Cavity quantum electrodynamics in solid-state systems
**Pradyumna Pathak**

Semiconductor QDs are attractive for realizing quantum optical phenomena in solid-state systems, offering advantages such as integrability and scalability. As artificial atoms, QDs have discrete energy levels due to strong quantum confinement of the electron-hole pairs, and they can be embedded or grown with high precision in different semiconductor microcavities at desired spatial positions. However, QD-cavity-qed systems rely on incoherent pumping of excitons. In incoherent pumping, the QD is excited in a quantum state far above from the desired exciton state, which relaxes quickly to the desired exciton state by phonon interactions. This type of excitation suffers from time uncertainty and efficiency and also led to undesirable background emissions. We have

developed Raman adiabatic passage type coherent excitation methods in quantum dots coupled with cavity.Normally quantum dots are grown by crystal mismatch between two semiconductor, thus two quantum dots are never similar and have different resonance frequency. When a cavity mode is resonant with one dot the presence of others does not interfere much. However, we have found in our studies that it is possible that two quantum dots can emit two photons in aoffresonant cavity mode cooperatively. This result opens up new nonliner interaction for generating two identical photon sources which are vital importance in quantum information processing. Necessary equipments like three workstations, printer and other stationery items have been procured.In coming years we will be exploring strip-line cavity-qed using NV centres and hybrids solid state systems. We will also be working on decoherence processes in such soild state systems.

## Isolation of natural products
## P.C. Ravikumar

Antioxidants from natural sources have gained importance because of the health hazards from synthetic antioxidants viz. butylatedhydroxytoluene (BHT), butylatedhydroxyanisole (BHA), *tert*-butylhydroquinone (TBHQ) and propyl gallate (PG). These synthetic reagents are widely being used in industries but they are suspected to be responsible for chronic diseases like alzheimers disease, mutations through DNA damage, lipid peroxidation and carcinogenic effects. Recently rigorous research on natural antioxidants has received considerable attention due to the side effects associated with synthetic reagents. Plants are the main sources of natural antioxidants. Phenolic compounds present in plants are mainly responsible for antioxidant activities. Antioxidants have high free radical scavenging properties that helps to reduce the risk of chronic diseases.

*Royleacinerea*belongs to the family Lamiaceae. The plant is a medium sized shrub reaching a height of 0.9--1.7 m widespread in the Himalaya from Kashmir to Nepal, at 1,200-3,700 m altitude. Leaves collected from this plant are widely used in traditional medicine.

We have performed antioxidant activity study of different solvent extracts of*Royleacinerea*. The free radical scavenging activities of the extracts were estimated by different chemical based assays viz. 2,2-diphenyl-1-picrylhydrazyl (DPPH), 2,2´-azinobis(3-ethyl-benzothiazoline-6-sulfonic acid (ABTS), ferric reducing antioxidant potential (FRAP) and oxygen radical absorbance capacity (ORAC). Aerial part of the plant was extracted with ethanol by maceration method and fractionation was done with different solvents in the increasing order of polarity. Butanol extract of *R. cinerea* showed the highest amount of phenolic and flavonoid contents. Total phenolic contents varied among four extracts from 3.87 to 95.3 mg gallic acid equivalent (GAE) per gram of dry weight. A significant positive correlation was observed between total phenolic and flavonoid contents ($R^2$ = 0.896).  In DPPH assay butanol extract showed the highest antioxidant potential. In ABTS and FRAP butanol extract also showed the highest antioxidant potential with low $IC_{50}$ values as compared to other extracts. Antioxidant activity increased with the increasing amount of extracts. Reducing power also showed similar result, and it also showed an increase with the increasing concentration of extract.

# School of Humanities and Social Sciences

The role and function of the humanist disciplines in the undergraduate engineering curriculum of the IITs has been universally recognized as an indispensable component. In assisting the potential technologist to attain the twin goals of individual excellence and happy harmony with society, the humanist disciplines need to be configured to meet immediate, practical, professional requirements without losing sight of the overriding claims of all-round liberal education. The School implemented for the first time in the B. Tech first semester the new curriculum comprising thirteen credits spread over five streams, viz., the a) Creative Stream b) International Language Competence c) Communicative Competence d) Social Competence and e) Managerial Competence. The Creative Stream was introduced in the fall semester where students had the option of choosing from three 1-credit courses, namely a) Art and Architecture b) Dance and Drama and c) Music. For this the School invited young and talented instructors from various parts of the country. An end of the year music production provided the capstone to the Creative Stream experience.At the higher semesters, HSS introduced new courses such as Technology in Pre-Modern India, International Business Management, Tribal India & Indigenous Latin America, Consumer Behavior, Organizational Behavior, Introduction to World History, Modern Literature and the Constitution of India.In addition, ten students were elected to minor in the newly introduced minor in German language. The School organized successfully one-credit workshops for the B.Tech students in a) HS 591: Some Aspects of Basic Finance for Engineers b) HS 591: Some Aspects of Elements of Cinema: Image, Story, Time c)HS 591: Some Aspects of Professional Leadership. Experts from other institutions conducted these programs on invitation by the School.The School invited noted economist Dr. RinkiSirkar to give a lecture on "Endangering the Endemic in the Western Himalayas: Tracking the Socio-Ecological Trajectory of Chilgoza-pine". During her visit Dr. Sarkar also teamed up with Mr. Chhearing representing an NGO in Lahaul-Spiti to augment a course on Tribal India & Indigenous Latin America by talking to students about folk culture in Himachal Pradesh. In the even semester the School hosted Prof. GernotSaalmann from University of Freiburg to give a lecture on "Pierre Bordieu's Thought and his relevance to India"as well as explore the possibilities of collaboration on a DFG project.

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## Research Projects

| S.No | Project | Sponsoring agency | Investigators | Project cost(in lac) |
|---|---|---|---|---|
| 1 | A Comprehensive Reader for the Humanities & Social Sciences<br><br>Date of sanction: 15.12.2012<br>Date of completion: 14.12.2015 | IIT Mandi | Prof. B. Subramanian | 5,00,000 |

**A comprehensive reader for the humanities & social sciences**
**B. Subramanian**
The project has for its objective the compilation of a carefully graded anthology for undergraduate engineering students, with the selected texts embracing mostly the areas of science, technology and society. Students, while engaging in technological discourse, are expected to remain open to the humanities and social sciences perspectives, so that the complexity of technology as well as the gamut of attendant arguments concerning science and technology remains discernible.  With this view in mind, every text is backed by relevant introduction, explanations, carefully chosen assignments and references for further reading. Sufficient progress has been made in the matter of identifying suitable texts. From here onwards, editing of the texts shall take place. It is hoped that this reader would serve as a model for engaging with humanist concerns in an engineering context.

## PAPERS PUBLISHED IN NATIONAL AND INTERNATIONAL JOURNALS

1.  Sharma D. and Azad S. Selection of India's Energy Resources using Fuzzy Vikor Method. OIDA International Journal of Sustainable Development 06: 19-36, 2013.

2.  Mathur S., Chauhan A., and Azad S. Ranking Indian States Based on Socio-Economic Factors. Advanced Science Focus, 2013 (In Press).

3.  Azad S. and Gupta A. Uncovering the Economic Coherence among the Asian Giants and the Western World. Advanced Science, Engineering, and Medicine 5: 1–5, 2013.

4.  Azad S., Mathur S., and Gupta A. Evaluating India's Strategic Partnership using Analytical Hierarchy Process. Advanced Science Focus 1: 96-101, 2013**.**

5.  Abbas S. Pseudo almost automorphic solutions of some nonlinear integro-differential equations. Computers & Mathematics with Applications 62:2259-2272, 2011.

6.  Abbas S. Existence and Attractivity of k-Pseudo Almost Automorphic Sequence Solution of a Model of Bidirectional Neural Networks. Acta Applicandae Mathematicae 119:57-74, 2012.

7.  Abbas S andYonghui Xia. Existence and attractivity of k-almost automorphic solutions of a model of cellular neural network with delay. Acta Mathematica Scientia 32B:1-13, 2013.

8.  Mahto L, Abbas S and Favini A. Analysis of Caputo impulsive fractional order differential equations with applications. Int J Differential Equations1-11, 2013.

9.  Sinha S, Kumar S, Koner RR, Mathew J, Nandi CK and Ghosh S. Carboxylated 'locking unit' directed ratiometric probe design, synthesis and application in selective recognition of $Fe^{3+}/Cu^{2+}$. RSC Adv 3: 6271–6277, 2013.

10. Sinha S, Koner RR, Kumar S, Mathew J, Roy A, Mukhopadhyay SK, Nandi CK andGhosh S. Structurally tuned benzo[*h*]chromene derivative as $Pb^{2+}$ selective 'turn-on' fluorescence sensor for living cell imaging. J Lumin 143: 355-360, 2013.

11. Chakraborti H, Sinha S, Ghosh S and Pal SK. Interfacing water soluble nanomaterials with fluorescence chemosensing: Graphene quantum dot to detect $Hg^{2+}$ in 100% aqueous solution. Mater Lett 97: 78-80, 2013.

12. Sinha S, Koner RR, Kumar S, Mathew J, Monisha PV, Kazi I and Ghosh S. Imine containing benzophenone scaffold as an efficient chemical device to detect selectively $Al^{3+}$.RSC Adv 3: 345-351, 2013.

13. Pandey R, ReddyL, Ishihara S, Dhir A and Krishnan V. Conformation induced discrimination between picricacid and nitro derivatives/anions with a Cu-pyrenearray: thefirst decision making photonic device, *RSC Adv.* (2013), DOI: 10.1039/c3ra44036b, 2013 (In press).

14. Venkataswralu M,Sinha S,Jomon M and Koner RR. Quencher displacement strategy for recognition of trivalent cations through 'turn-on' fluorescence signaling of an amino acid hybrid. *Tetrahedron Letters* 54:4683, 2013.

15. Gabb D, Pradeep CP, Miras HN, Mitchell SG, Long DL and Cronin L. Organic-soluble lacunary $\{M_2 (P_2W_{15})_2\}$ polyoxometalate sandwiches showing a previously unseen αββα isomerism. Dalton Trans 41: 10000–10005, 2012

16. Li F, Long DL, Cameron JM, Miras HN, Pradeep CP, Xu L and Cronin L. Cation induced structural transformation and mass spectrometric observation of the missing dodecavanadomanganate (IV). Dalton Trans 41: 9859–9862, 2012

17. Yin P, Pradeep CP, Zhang B, Li FY, Lydon C, Rosnes MH, Li D, Bitterlich E, Xu L, Cronin L and Liu T. Controllable self-assembly of organic–inorganic amphiphiles containing Dawson Polyoxometalate clusters. Chem Eur J 18: 8157–8162, 2012

18. Pradeep CP and Das SK. Coordination and supramolecular aspects of the metal complexes of chiral N-salicyl-β-amino alcohol Schiff base ligands: towards understanding the roles of weak interactions in their catalytic reactions. Coord Chem Rev 257: 1699-1715, 2013

19. Gabb D, PradeepCP,Boyd T, Mitchell SG, Miras HN, Long DL and Cronin L. A general route for the transfer of large, highly-charged polyoxometalates from aqueous to organic phase.Polyhedron 52:159–164,2013

20. Rosnes MH, Musumeci C, Yvon C, Macdonell A, Pradeep CP, Sartorio C, Long DL, Pignataro B and Cronin L. Exploring the Interplay Between Ligand Derivatisation and Cation Type in the Assembly of Hybrid PolyoxometalateMn-Andersons. Small, Article first published online: 7 FEB 2013, DOI: 10.1002/smll.201202510

21. Siril PF,Lehoux A,Ramos L,Beaunier P, and RemitaH.*Facile synthesis of Palladium nanowires by soft templates.*New Journal of Chemistry 36: 2135-2139, 2012

22. Dhir A, Pradeep CP and Rambabu D. Nano Dispersion of 3DCd(II) Coordination Polymer: Synthetic Blood Plasma Anticoagulant 2013*(Communicated)*.

23. Dhir A, Pradeep CP and Devi M. Au Micro Particles Mediated Construction of Logic Based Dual Channel Molecular Keypad Lock. Dalton Trans 42*:*7514-7518, 2013.

24. Tripathi JP, Abbas S and Thakur M. Stability analysis of two prey one predator model. In Proceedings of International Conference of Numerical Analysis and Applied Mathematics 1479:905-909, 2012

25. Khan S,Gupta A, Nandi CK. Controlling the fate of protein corona by tuning surface properties of gold nanoparticles.*J Phys Chem Letters* 4:3747-3752, 2013.

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35. Sahota PK, Liu Y, Skomski R, Manchanda P, Zhang R, Franchin M, Fangohr H, Hadjipanayis GC, Kashyap A and Sellmyer DJ. Ultrahard magnetic nanostructure. J Applied Physics 111:07E345, 2012.

27. Zhang R, Skomski R, Xingzhong Li,1 Zhen Li, Manchanda P, Kashyap A, Roger D. Kirby, Sy-Hwang Liou, and D. J. Sellmyer. L10 CrPt phase formation and magnetic properties. J Applied Physics 111:07D720, 2012.

28. Sharma V, Skomski R and Kashyap A. First Principles Exchange Interactions in Mn doped III-V Semiconductors. Magnetism and Magnetic Materials 324:786, 2012.

29. Manchanda P, Sahota PK, Skomski R and Kashyap A. Magnetoelectric effect in organometallic Vanadium-Benzene wires. Chemical Physics Letters 568:121, 2013

30. Rana TH, Sahota PK, Solanki AK, Skomski R and Kashyap A. Ab-initio study of free standing TiO2 clusters: Stability and magnetism.J Applied Physics 113:17B526, 2013.

31. Das B, Balamurugan B, Sahota PK, Skomski R, Shah VR, Shield JE, Kashyap A and Sellmyer DJ. HfCo7-based Rare-Earth-free Permanent-Magnet Alloys. IEEE Trans Mag 49:3330-3333, 2013.

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34. Sharma V, Manchanda P, Sahota PK, Skomski R and Kashyap A. Interatomic exchange in Mn-doped IIIaE"V semiconductors. Magnetism and Magnetic Materials 324:786, 2012

35. Radhamany B, Singh S, Singh N, Ranjan R, Maiti K, Hill AH, and Barman SR. Structural and Electronic structure studies of different transition metal oxides Phys Rev B 86:140104 (R), 2012.

36. Chauhan A and Vaish R.  Pareto-optimal microwave dielectric materials. Advanced Science, Engineering and Medicine 5:149, 2013

37. Chauhan A and Vaish R. Hard coating material selection using multi-criteria decision making Materials and Design 44:240, 2013

38. Chauhan A and Vaish R. Material selection for piezoelectric devices Advanced Science, Engineering and Medicine5:715, 2013

39. Preethi Meher KRS, Vaish R, Hou J, Krsmanovic D, Varma KBR and Kumar RV. Ferroelectric relaxor behavior of $Ca_{0.180}Sr_{0.226}Ba_{0.594}Nb_2O_6$ceramics. Int J Mater Res..104:168, 2013

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41. Chauhan A and Vaish R. A comparative study on material selection for micro-electromechanical systems. Materials and Design41:177, 2012

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43. Mereshchenko AS, Pal SK, Karabaeva KE, El-Khoury PZ and Tarnovsky AN. Photochemistry of Monochloro Complexes of Copper(II) in Methanol Probed by Ultrafast Transient Absorption Spectroscopy. J Phys Chem  A 116: 2791-2799, 2012.

44. Ray RK, Mittal HVR. A Transform-Free HOC Scheme for IncompressibleViscous Flow past a Rota- tionally Oscillating Circular Cylinder. World Academy of Science, Engineering and Technology 72: 1365-137,2012.

45. Jose PP and Andricioaei L. Similarities between protein folding and Jamming. Nature Communications 3:1161, 2012.

46. Dutt V and Gonzalez C. Enabling eco-friendly choices by relying on the proportional-thinking heuristic. Sustainability 5: 357-371, 2013.

47. Dutt V and Gonzalez C. Reducing the linear perception of non-linearity: Use of a physical representation. J of Beh Decis Mak 26: 51-67, 2013.

48. Gonzalez C and Dutt V. Data aggregation and ensuing problems for the IBL model: A reply to Hills and Hertwig. Psych Rev 119: 893-898, 2012.

49. Dutt V and Gonzalez C. Making instance-based learning theory usable and understandable: The instance-based learning tool. Comp in Hum Beh 28:1227-1240, 2012.

50. Dutt V and Gonzalez C. The role of inertia in modeling decisions from experience with instance-based learning. Front in Psych 177:1-12, 2012.

51. Dutt V and Gonzalez C. Decisions from experience reduces misconceptions about climate change. J of Environ Psych. 32:19-29, 2012.

52. Ramna. Extent of absolute poverty in rural sector of Himachal Pradesh: A measure of unemployment. Int Commerce and Management 3:1-4, 2013.http://ijrcm.org.in/

53. Ramna. Relative poverty and inequality – A study of Himachal Pradesh, Int. Computer Application and Management 3:1-7,2013. http://www.ijrcm.org.in/comapp/

54. Devadevan MV. Nadu Nudiya Adhyayana (In Kannada). Lokajnana, The TriennialJournal of Tumkur University 1:2013. (Reprinted in Samshodhana Vyasanga, 23:149, 2013)

55. Devadevan MV. The Taste of the Nation: Golwalkar's Nationhood and Its Mentality. Phalanx 9, 2013.http://phalanx.in/pages/article_I009_ Nationhood.html.

56. Devadevan MV. A Passe on Somanathapura (Review of S. Settar's Somanathapura). Indian Literature (Sahitya Akademi's Bi-monthly Journal), 57:218-220, 2013.

57. Devadevan MV. Abraham bin Yiju (in Kannada), *Itihasa Darpana*,    17: 39-46, 2013.

58. Diwaker and Chakraborty A. Curve Crossing Problem with Gaussian type Coupling: Analytically Solvable Model. Molecular Physics 110: 2197-2203, 2012.

59. ·Diwaker and Chakraborty A.  Multi-channel scattering problems - An analytically solvable model. Molecular Physics 110: 2257-67, 2012.

60. Chakraborty A. Review of the book - Disordered Semiconductors - Physics and Applications (Author: Anatoly Popov) : Contemporary Physics, 53:534, 2012.

61. Chakraborty A. Review of the book - The Thermodynamics of Quantum Yang–Mills theory, Theory and Applications (Author: Ralf Hofmann) : Contemporary Physics, 53: 539, 2012.

62. Chakraborty A. Review of the book - The Physicist's World: The Story of Motion and the Limits to Knowledge (Author: Thomas Grissom): Contemporary Physics, 53:440, 2012.

63. Chakraborty A.  Review of the book - Relativistic Quantum Physics: From Advanced Quantum Mechanics to In-troductory Quantum Field Theory (Author: Tommy Ohlsson): Contemporary

Physics, 53: 287, 2012.

64. Chakraborty A. Review of the book, Introduction to Quantum Mechanics: Schrodinger Equation and Path Inte-gral (Author: Harald J W Muller-Kirsten): Contemporary Physics, 54:79, 2013.

65. Chakraborty A. Review of the book - Quantum Bio-informatics IV: From Quantum Information to Bio-Informatics (Editors: Luigi Accardi, Wolfgang Freudenberg, Masanori Ohya): Contemporary Physics, 53:537, 2012.

66. Manchanda R, Skomski R, Prabhakar A and Kashyap A. Magnetoelectric effect in Fe linear chains on Pt(001)P. J Applied Physics 2013 (In press).

67. Kumar P, Skomski R, Manchanda P, Kashyap A and Dowben PA. Effective Mass and Band Gap in strained Graphene. Dowben Current Applied Physics, Accepted 2013 (In press).

68. Kumar P, Kashyap A, Balamurugan B, Shield JE, Sellmyer DJ and Skomski R. Permanent magnetism of intermetallic compounds between light and heavy transition-metal elements, J Physics: Condensed Matter 2013 (In Press).

69. Lewis LH, Mubarok A, Poirier E, Bordeaux N, Manchanda P, Kashyap A, Skomski R, Goldstein J, Pinkerton FE, Mishra RK, Kubic Jr. RC and Barmak K. Inspired by Nature: Investigating Tetrataenite for Permanent Magnet Applications. J Physics: Condensed Matter, Accepted 2013 (In press).

70. Kumar P, Skomski R, Manchanda P and Kashyap A. *Ab initio* study of anisotropy and nonuniaxial anisotropy coefficients in Pd nanochains, Chemical Physics Letters 583:109, 2013.

71. Sharma SK, Gaur H, Kulkarni M, Patil G, Bhattacharya B and Sharma A. PZT-PDMS composite for active damping of vibrations. Composites Science and Technology 77: 42–51, 2013.

72. Sharma SK, Barthwal S, Singh V, Kumar A, Dwivedi PK, Prasad B and Kumar D. PECVD based silicon oxynitride thin films for nano photonic on chip interconnects applications. Micron 44: 339–346, 2013.

73. Manchanda P, Skomski R, Shield JE, Constantinides S and Kashyap A. Intrinsic Magnetic Properties of L10-Based Mn-Al and Fe-Co-Pt Alloys, REPM'12 - Proceedings of the 21st Workshop on Rare-Earth Permanent Magnets and their Applications. 115, 2012

74. Coupling R, Skomski R, Sahota P, Balamurugan B, Shield JE, Kashyap A and Sellmyer DJ. Geometrical Aspects of Hard-Soft Exchange, REPM'12 - Proceedings of the 21st Workshop on Rare-Earth Permanent Magnets and their Applications. 155, 2012

## Books/Book Chapters Published

1.	Varun Dutt and Gonzalez C. Climate Risk Communication: Effects of cost, timing, and probability of climate consequences in decisions from description and experience In C. L. Fung (Ed.), Psychology of Policy Making (pp. 23-48), Hauppauge, New York: Nova Science Publishers, 2013.

2.	Varun Dutt and Gonzalez C. Responding linearly in nonlinear problems: Application to earth's climate In M. Carpenter & E. J. Shelton (Eds.), Carbon Dioxide Emissions: New Research (pp. 15-30), Hauppauge, New York: Nova Science Publishers, 2013.

3.	Varun Dutt. Why Do We Defer Actions on Climate Change? A Cognitive Perspective. In M. Carpenter & E. J. Shelton (Eds.), Carbon Dioxide Emissions: New Research (pp.1-14), Hauppauge, New York: Nova Science Publishers, 2013.

4.	Bharat Singh, Singh SN and Wang L. Electric Grid Connections and System Operational Aspects of Wind Power Generation. In the book entitled "Wind Energy Conversion System: Technology and Trend" Berlin: Springer-Verlag, pp. 267-293, Ed Muyeen SM. Jan. 2012.

5.	Ramna. Women's Empowerment in Rural India, Gender Justice and Women Empowerment: an Integrated Approach. Regal Publications New Delhi, pp 87-99,2013.

6.	Ramna. Impact of economic liberalization on micro, small and medium enterprises in Himachal Pradesh, Economic Liberalization: Effects and Challenges, Kaniska Publishers and Distributers, New Delhi, ISBN: 978-81-8457-382-4, pp 151-157, 2012

## Conferences attended and papers presented

1.	Azad S, Bansal A. and Lio' A. Malaria Epidemic Prediction and Intervention in South East Asia Region, ECCS'12 Satellite Meeting, Data-driven modeling of contagion processes, UniversitéLibre de Bruxelles, Brussels, Belgium, September 2012

2.	Aggarwal S, Dewan H, and Azad S. Epidemic Spreading and Risk Perception in Community Networks in Indian States, International Conference on Networks in Biology, Social Science and Engineering, Indian Institute of Science, Bangalore, July 2012

3.	Dutt S, Chawla M, Sharma V and Siril PF. Facile synthesis of polyanilinepano structures using swollen liquid crystal templates and their glucose sensing activities, Fifth International Conference on Electroactive Polymer: Materials and Devices (ICEP 2012), IIT BHU, Varanasi, November 4-9, 2012.

4.	Kumar R andSiril PF. Preparation and characterization of nano-RDX International Conference on Functional Materials for Defence (ICMFD-2012), DIAT, Pune, 18-20 May, 2012.

5.	Dutt S, Chawla M and Siril PF. Synthesis and characterisation of conducting polymer nanostructures and their composites with palladium, International Conference on Functional Materials for Defence (ICMFD-2012), DIAT, Pune, 18-20 May, 2012.

6.	Kumar R and Siril PF. An overview of drug nanoparticles, poster presented National

Symposium on Nanobiotechnology (NSNT-2012), IIT Mandi,1-2 June, 2012.

7.    Dutt S, Chawla M and Siril PF. Synthesis of Polyaniline Nanostructures and their Composites for Bio-sensing Applications, poster presented National Symposium on Nanobiotechnology (NSNT-2012), IIT Mandi, 1-2 June, 2012.

8.    Dutt S, Chawla S, Sharma V and Siril PF. Novel Synthesis of Polyaniline Nanostructures using 'Swollen Liquid Crystal' Templates for H2O2 and Glucose Bio-Sensing, National Seminar on Physics and Technology of Sensors (NSPTS-2013), JamiaMiliaIslamia, New Delhi, March 2013.

9.    Nandi CK and Chaudhury A. Conformational dependent fluorophorenucletide interaction in thrombin binding aptamer, National symposium on Nanobiotechnology (NSNT-2012) IIT Mandi June, 2012.

10.   Gupta A and Nandi CK. Anisotropic core shell Au@Ag nanoparticles: synthesis, characterization and plasmonic interaction with chromophore molecule, National symposium on Nanobiotechnology (NSNT-2012) IIT Mandi June, 2012.

11.   Chaudhury A, Praveen G and Nandi CK. Fluorescence quenching of Rhodamine 6G and Rhodamine B dyes by 1-10 nm gold nanoparticles: A comparative study, National symposium on Nanobiotechnology (NSNT-2012) IIT Mandi 1-2 June, 2012.

12.   Jain S, Mittal U, Jalota H, Thakur M and SinhaN. An Integrated Approach Towards Optimization of Retail Supply Chains in Mountain Regions 6th International Conference on Quality, Reliability and Infocom Technology (ICQRIT2012), 26th   to  28th November 2012, Delhi, India.

13.   Radhamany B. Invited talk at EXAFS theme meeting'12 held at RRCAT, Indore

14.   Abhishek NV, Mathur S, Bhuvaneshwari S and Rajpurohit BS. Experience of Virtual Education at IIT Mandi: Perspective of Users, International Convention on Virtual Education: Issues, Challenges and Prospects, New Delhi, Feb 24-25, 2012.

15.   RajpurohitBS, Singh SN and Wang L. "Technical and Economical Practices for Alternative Energy in India," *IEEE PES General Meeting*, San Diego, USA, July 22-26, 2012.

16.   Chauhan RK**,** Rajpurohit BS and Pindoriya NM. "DC Power Distribution System for Rural Applications," 8th national conference on Indian energy sector – Synergy with Energy and exhibition–INDIAN ENERGY SHOW 2012, pp. 108-112, Ahmedabad, Gujarat, India, Oct. 11-12, 2012.

17.   Chauhan VS, Kishan PA and Gedupudi S. Combined Cycle for Power Generation and Low Temperature Refrigeration Using Low Temperature Heat Sources, in *Proc. International renewable energy congress*, Sousse, Tunisia, December 20-22, 2012, pp. IREC 2012-MSC-166/P.

18.   Arun Kumar and Singh OP. Role of PCM for energy saving in buildings located at complex terrain in Himalayan regions, International conference on renewable energy, Eternal University, Baru Sahib, HP, 5-6 May, 2012.

19.   Arun Kumar and Singh OP. Energy saving potential of composite walls of  buildings lacated at

complex terrain in Himalayan region, 2nd national conference of IBPSA-India on simulation of buildings for energy efficiency and better built environment, MNIT, Jaipur, India, 21-22 Dec, 2012.

20. Ray RK, Kalita JC. An efficient higher order accurate scheme fortwo-dimensional Immersed Interface problems. In: Third InternationalConference on MetaComputing (ICoMeC), December 6-7,2012; Bhubaneswer,India.

21. Ray RK, Mittal HVR. A Transform-Free HOC Scheme for IncompressibleViscous Flow past a Rota- tionally Oscillating Circular Cylinder. In:International Conference on Mathematical, Computational and StatisticalSciences, and Engineering (ICMCSSE 2012), December 22-23, 2012, Bangkok,Thailand

22. Nandi CK. "Towards practical applications of gold nanoparticle in life and environment" at Indian Association for the cultivation of Sciences (IACS Kolkata) on 6th July 2012.

23. Nandi CK. "DNA aptamer conjugated gold nanoparticles for targetting cancer cell" at Indian Institute of Technology Mandi, HP in the first National symposium on Nanobiotechnology (NSNT-2012) IIT Mandi, 2012.

24. Thakur M. Recent Advances In Genetic Algorithms and Their Applications (RAGATA 2012) IIT Roorkee 25 - 29 June, 2012.

25. Thakur M. Computational Intelligence Applications to Renewable Energy, IIT Mandi during July 09-13, 2012.

26. Thakur M. National conference on "Contemporary developments in mathematical sciences and computing" Galgotias University 2- 3 Feb, 2013.

27. Thakur M. National Programme for Training of Scientists & Technologists Working in Government Sector on Soft Computing Techniques for Optimization Indian Institute of Information Technology and Management Gwalior March, 04-09 2013.

28. Siril PF. National Symposium on Nanobiotechnology (NSNT-2012) "*Novel methods for the preparation of drug nanoparticles*" 1-2 June, 2012, IIT Mandi.

29. Rajpurohit BS. 'Large Scale Grid Integration of Renewable Energy Sources: Key Issues and Challenges', National workshop on "Power Generation from Renewable Energy Sources" organized by Centre for Energy & Environment National Institute of Technology, Hamirpur. 23-24th March 2013.

30. Ramna. Quantifying Income and Consumption Inequalities: Some Evidence from Rural Sector of Himachal Pradesh. Economic Association of Himachal Pradesh, Himachal Pradesh University, Shimla, December, 2012.

31. Dutt R.Becoming Political: Mayan Caciques in Early National Yucatan" , Plenary talk in Yucatan in PA Roundtable Conference at University of Pennsylvania, Philadephia, March 1, 2013.

32. Kashyap A. "IIT Mandi: New project center of WPI", Massachusetts, March 16-23, 2013.

33. Siril PF. Continuing Education Programme on High Explosive Technology "*Nano Energetic*

*Materials*" 11-15 February, 2013, TBRL, Chandigarh.

34. Siril PF. Continuing Education Programme on High Explosive Technology "*Green Energetic Materials*" 11-15 February, 2013, TBRL, Chandigarh.

35. Chakraborti H., Pal, SK. "Photoinduced Interactions Between Fluorescein Dye and Graphene" National Symposium on Nanobiotechnology, IIT Mandi, June 1-2, 2012.

36. Kumar P. and Pal SK. "Quenching of Defect Emission of ZnO Quantum Dot in the Presence of Fluorescein Dye" National Symposium on Nanobiotechnology, IIT Mandi, June 1-2, 2012

37. Reddy R, Kanaparthi BR and Dutt V. Testing the Effects of Recency and Inertia on Cyber Threat Detection Through Instance-Based Learning, 3rd IEEE International Advance Computing Conference (IACC-2013), Ghaziabad, India, Feb 22-23, 2013.

38. Dutt V.Information Search in Decisions from Experience: Influence of Variability and Timing on Patterns of Sampling, 2012 Annual Convention of National Academy of Psychology (NAOP), Bangalore, India, Dec 10-12, 2012.

39. Gonzalez C, Dutt V, Martin J and Ben-Asher N.Decisions from Experience in Conflict Situations: A Cognitive Model of the Effects of Interdependence Information, Behavioral Decision Research in Management (BDRM) conference, Boulder, Colorado, Jun 27-29, 2012.

40. Dutt V. Keynote talk in the plenary session ("Promising Young Indian Contributors to Psychological Sciences") Twelweth Annual Convention of National Academy of Psychology, Bangalore.December 10-12, 2012.

41. Shejin T. and Anil Kumar Sao, "Significance of dictionary for sparse coding based face recognition," in Proc. of the International Conference of the Biometrics Special Interest Group (BIOSIG), Sept. 2012, pp. 1–6.

42. Anand Srivastava. "Next Generation PON Evolution" Invited paper in SPIE Photonics West 2013, 2nd-7th Feb. 2013, San Francisco, USA.

## Memberships of Professional Societies

1. Devadevan MV. Fellow of the Royal Asiatic Society of Great Britain and Ireland.

2. Nandi CK. Secretary"Society for Nanobiotechnology".

3. Thakur M. Member, Elected IEEE Delhi Section PES/IAS Chapter for 2013-14.

4. Dutt V. Active member of Institute of Electrical and Electronics Engineers (IEEE), Inc, USA (www.ieee.org)

5. Dutt V. Active member of System Dynamics Society (SDS), USA (http://www.systemdynamics.org)

6. Dutt V. Member of Society of Risk Analysis (SRA), USA (http://www.sra.org/)

7. Dutt V. Member of Division 34 [Population and Environmental Psychology], American Psychological Association, USA (http://www.apa.org/divisions/div34/)

8. Dutt V. Member of Society of Judgment and Decision Making, USA (www.sjdm.org)

## Visit to Academic/ Industrial Organizations

1.  Singh OP. Visited Altair Engineering Inc. New Delhi in December, 2012.

2.  Rajpurohit BS. Organized visit to Larji Hydel Power Project (126 MW), Mandi and Electric Substation (132/33 kV) at Bijni, Mandi, H.P. on 20/04/13.

3.  Rajpurohit BS. Organized visit to Larji Hydel Power Project (126 MW), Mandi and Electric Substation (132/33 kV) at Bijni, Mandi, H.P. on 29/04/12.

4.  Rajpurohit BS. Organized visit to Dehar Power House (900 MW), Slapper, Mandi, H.P. on July11, 2012.

5.  Chakraborty A. Started working on Mathematica (www.wolfram.com) endorsed projects.

## Outreach activities

1.  Singh OP. delivered a guest lecture on "How to develop scientific temper among the students", at Jawahar Navodaya Vidyalaya, Pandoh, Mandi

2.  Thakur M. Conducted screening of a movie entitled "The Genius of SrinivasaRamanujan" on the life of great Indian Mathematician SrinivasaRamanujan on April 26th, 2013 and invited students and faculty of educational institutes of Mandi.

3.  Dutt V. An article published in Science Daily and several other newspapers:*http://www.sciencedaily.com/releases/2012/11/121130222253.htm*

4.  Dutt V. An article published in Zee news: *http://zeenews.india.com/news/world/us-vulnerable-to-cyber-pearl-harbour-says-panetta_814200.html*

5.  Dutt V. Article published: http://www.mydigitalfc.com/news/cyber-pearl-harbor-164

## Awards & Achievements

1.  Vaish R. INSA Medal for Young Scientist-2013.

2.  Vaish R. IEI Young Engineers Award 2012-2013.

3.  Vaish R. Visiting fellowship-2012-2013 for JNCASR, Bangalore.

4.  Lead Author for Chapter 2 on "Integrated Risk and Uncertainty Assessment of Climate Change Response Policies" in UN's IPCC (WG III) 5th Assessment Report (Ar5)

5.  Reached the final round of MIT Technology Review Young Innovators Under 35 Awards, 2013

# COLLOQUIUM/ INVITED LECTURES

Eminent academicians, scholars, scientists, industry leaders and policy makers were invited to share their expertise with the students and faculty and deliver lectures on the subject of their expertise.

1. Power Electronics Applications in Power System: Prof. Mahesh Kumar Mishra, IIT Madras, May 17, 2012.

2. Linking Education, Employment and Development through Community Knowledge Enterprises: Prof. K.R. Srivathsan, Chinamaya Institute of Technology in Kannur, June 28, 2012.

3. War and Peace: Conflict and Cooperation in an Insect Society: Prof. Raghavendra Gadagkar, IISc, Bangalore, October 23, 2012.

4. The first experimental achievement at IIT Mandi for a fluorogenic sensor starting from scratch, Dr. Rik Rani Koner, IIT Mandi, November 30, 2012.

5. The Internet without IP addresses: A new approach to the Internet Architecture:

   Dr. Saleem Bhatti, University of St Andrews, March 07, 2013.

## MEMORANDUM OF UNDERSTANDING

To promote academic research, cooperation and development of technical education the following MoUs have been signed during the year 2012-13.
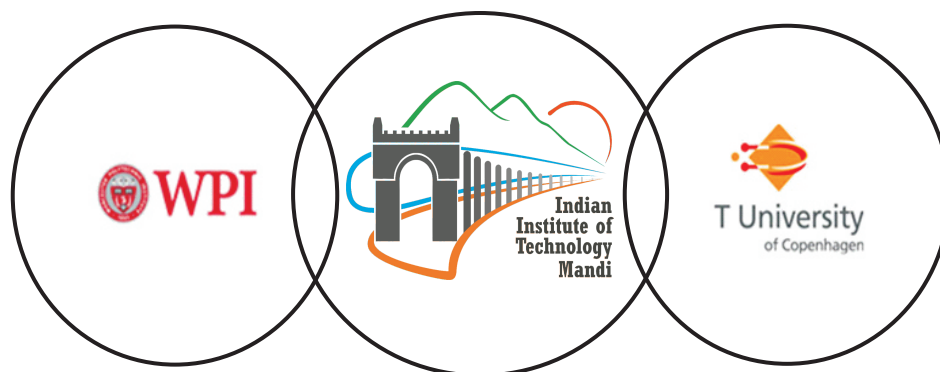


1.  Worcester Polytechnic Institute, USA (Represented by Dr. Eric Overstrom, Provost and Senior Vice President, Worcester Polytechnic Institute (WPI)) –MoU signed for academic research collaboration in the areas of mutual interest, exchange of academic information, scholarly information, materials and publications, exchange of students and faculty,organization and sponsorship of cooperative seminars, workshops and other academic meetings.

2   IT University of Copenhagen, Denmark (Represented by Dr. MadsTofte, Vice Chancellor, IT University of Copenhagen) – MoU signed for academic and research collaboration and exchange of students and faculty.

## Advanced Materials Research Center

The Advanced Materials Research Center was established during 2012-13. It is a centralized research facility which houses several instruments that are vital for the detailed characterization of advanced materials. Some of the major instruments are:

◈ UV-Vis spectrophotometer

◈ Atomic Absorption spectrophotometer

◈ Dynamic Light Scattering

◈ Optical Microscope

◈ Fluorescence Spectrometer

◈ Thermo Gravimetric Analyzer coupled with Differential Scanning Calorimetry

◈ Electrochemical Analyzer

◈ Fourier Transform Infrared Spectrometer

◈ High Performance Liquid Chromatography

The major equipment procured during 2012-13 are:

High Resolution Transmission Electron Microscope (TEM) – Energy Dispersive Spectroscopy (EDS)

Powder X-ray Diffractometer

Confocal Microscopy

Nuclear Magnetic Resonance Spectrometer – 500 MHz

Instruments to be installed in the near future are:

◈ Single Crystal X-ray Diffractometer

◈ HR-Mass Spectrometer coupled with Gas Chromatography

◈ Femtosecond Laser Pump-probe Setup

◈ Scanning Electron Microscopy – Electron Beam Lithography

◈ Atomic Force Microscopy

◈ SQUID Magnetometer

◈ Physical Properties Measurement System (PPMS)

Thermo-fluids and Design Labs

◈ NI Data Acquisition Unit

◈ Phantom high speed video camera

◈ Coriolis flow meter

◈ Pressure calibration system

◈ Temperature calibration system

Characterization and Synthesis Lab

◈ Fume Hood

◈ Rotary Evaporator

◈ Double Stage Water Purification System

◈ Ultra Centrifuge with refrigeration

◈ Muffle Furnace

◈ Deep Freezer

◈ Vacuum Oven

◈ Flake Ice Making Machine

◈ Programmable Spin Coater

◈ Ozone Generator with Oxygen Concentrator.

◈ Magnetic susceptibility balance

◈ Spectrofluorometer

◈ Ozonator

◈ Polarimeter

◈ GC

◈ Time-Correlated Single Photon Counting (TCSPS)

## Computational Facilities

The high performance computing facility at IIT Mandi is operational. It is a 128-core rack mounted cluster with Xeon 2.4 GHz quad core processor, 8GB memory per node, Gigabit Ethernet Interconnect, and 6TB storage and can support 256 threads. It has a RAM of 1GB per core. This is rocks cluster with open PBS queuing. The campus is equipped with 1 Gb/s NKN connection and 45 Mb/s Internet connection.

# RESEARCH INITIATIVES

## Green Energy

IIT Mandi aims at development of Green Energy technologies — solar, hydro, wind, geothermal and bio-mass in the next five years. Hydro and geothermal are especially relevant in the Himalayan region where IIT Mandi is situated. The Institute interests are on matters relating to multiple dimensions of green energy including energy education, energy conversion, energy policy, energy efficiency, energy conservation and load management, energy storage, renewable energy, distributed generation, protection of environmental resources, and the dissemination of useful information on energy alternatives and sustainability to users and providers of energy.

IIT Mandi is pursuing the following key research areas. This is reflected in both research as well as in educational activities.

◈ Information and communication technologies applications to green energy.

◈ Integration of green energy with sustainable and intelligent buildings.

◈ Power electronics applications to green energy.

◈ Power systems operation with green energy.

◈ Materials (nano, meta, bio and high energy) applications to green energy.

◈ Green energy regulatory and policies issues.

◈ Current Research Objectives

Some of the important ongoing research thrusts are highlighted below.

• **Grid-connected/stand-alone power electronic converter control :** In the growing electricity supply industry and open access market for electricity worldwide, renewable energy sources (RES) are getting added into the electric grid system. Power electronic systems (PES) are the crucial interfacing devices which matches output voltage, perform DC to AC (or AC to DC) conversion, control power quality and power flow, and have high efficiency on 10% to 100% power range. The objective of the research is to develop simulations and experimental set-ups for interfaces for RES with grid connected PES control using intelligent and advanced digital signal processing techniques. A significant emphasis is placed on the cost-effective utilization of this energy resource to simultaneously achieve a quality and reliable power supply.

**B. S. Rajpurohit**

• **Energy storage:** One of the major thrust areas for research in IIT Mandi is to develop storage devices for large quantities of electricity generated from renewable energy sources such as solar or wind power. The storage of electrical energy is also required for devices rangeing from a cellular phone to highly compact electronic devices implanted in a body to electric vehicles. Within this context, research has been initiated here to develop high energy density capacitors using functional oxide materials. The research involves (a) materials development (selection of materials and bulk processing), (b) studying the structure

property relationship of the materials by using various electrical and structural characterization techniques, (c) fabricateingdevices in the form of films or multilayered structures. Various structural and thermodynamic aspects are considered to understand and optimize the device physics of these. The measurements include dielectric permittivity, energy storage density and leakage currents etc. The structural study involves characterization using TEM, SEM and X-ray diffraction techniques.

**Akansha Dwivedi & Rahul Vaish**

- **Improving efficiency of plastic solar cells :** Polymer solar cells have attracted much scientific attention in spite of poor power conversion efficiency because of the possibility of fabricating large area devices by solution-processing onto flexible and lightweight plastic substrates. The main research goals include development of novel conjugated polymers, new device architecture and morphology optimization for the betterment of the device efficiency. Design and synthesis of conjugated polymers having low band gap and high hole mobility will be undertaken. Electrical parameters of the solar cells will be measured preceded by fabrication of devices using synthesized polymers. Study of time evolution of charge carriers employing steady state and time-resolved spectroscopic techniques will help to understand the role of nanomorphology on the device efficiency.

**Suman K. Pal, Subrata Ghosh & Chayan K. Nandi**

## Materials Science

The IIT Mandi has a strong vision to form an active materials science research group. The Institute focuses on practical applications and dissemination of materials like smart material, high energy materials, nanostructured materials for biomedical and sensing applications, materials for high density magnetic storage devices, polyoxometalate based cluster materials for solar cell, photocatalysis etc. In order to achieve excellence and high quality research, IIT Mandi will strongly foster inter-disciplinary research and development. Some of the important research areas on material are highlighted below.

- **Development of smart complex oxide materials** : Development of smart complex oxide materials by applying fundamental principle of material sciences. Specific interest includes developing bulk and thick films of functional oxides materials and studying their structure-property-performance relationship for various applications such as sensors, actuators and high energy density capacitors. The main research will focus on understanding both kinetic and thermodynamic aspects of the fabrication process of these materials, interfacial phenomena in multilayer devices, developing high temperature piezoelectric materials. Finite element modeling of the smart materials in order to determine the static and dynamic response. This is carried out to test whether a structure (made of smart material) can bear/sustain the loading conditions.

**Rahul Vaish, Akansha Dwivedi & Rajeev Kumar**

- **Complex transition metal oxides for high density magnetic storage devices** : The research focus on complex transition metal oxides  which find its use in high density

magnetic storage devices, magnetic read write devices, eco friendly electronic materials e.g. lead free thick film resistor, fuel cell and battery applications etc. The research interest lies in understanding the evolution of electronic structure and associated local structural changes in various complex transition metal oxides across electronic and magnetic phase transitions. In these kinds of materials, the physical properties are governed by the intricate interplay among the charge, orbital and spin degrees of freedom.

**Bindu Radhamany**

- **Biomedical applications of nanomaterials** : In this part of research the main focus will be on the specific targeting on the cancer cells as well as other therapeutic by synthesizing different size gold nanoparticles attached to DNA aptamer and characterizing the electronic and optical properties of Au-NP's. AuNP's are highly promising for potential applications in understand the selection of effective therapeutic pathways and improve clinical outcomes, sensitive and simultaneous diagnosis of multiple trace biomarkers from complex living samples which is particularly critical in the early stages of tumor development in cancer therapy. The role of aptamer will be as biomolecular sensor, while the gold nanoparticles as contrasting agent.

**Chayan Kanti Nandi**

- **Nano-scale light harvesting device fabrication** : Development of Polyoxometalate (POM) based cluster materials and organic-inorganic hybrids for various materials and catalytic applications. Polyoxometalates often contains nano-sized oxygen cluster anions formed by early transition metals in their highest oxidation state. The targeted applications include nano-scale device fabrication, light harvesting and water splitting complexes. This kind of POM can be used as components in solar cell, photocatalyst, water oxidation catalyst etc.

**Pradeep Parameswaran**

- **Supramolecular high energetic compounds (Supra-HECs)** : Research in the field of energetic materials is generally directed towards achieving enhanced performance and reduced sensitivity. Novel energetic compounds with above stated properties are required to enhance the performance of munitions and propellants. Molecules such as RDX and HMX that has been introduced decades back still continues to be the work horse energetic compounds. Leaping forward in achieving much higher performance and safety requires concerted and co-ordinated efforts from synthetic organic chemists, physical chemists and theoretical modeling.

**Subrata Ghosh, Prem Felix Siril & Aniruddha Chakraborty**

- **Synthesis of nanostructured materials using `soft' templates** : Swollen liquid crystals (SLCs) are a class of lyotropic liquid crystals that can be used as 'soft' templates for the synthesis of nanostructures of metals. The SLCs are composed of oil-swollen cylinders hexagonally packed in a continuous water domain. Such soft mesophases, for which the

radius of the surfactant tubes and the thickness of the water channel between adjacent tubes can be controlled independently over large range, are attractive candidates for the synthesis of structured nanomaterials. This part of research on material science focus on nanocrystallisation of organic materials using SLC templates, preparation of noble metal and alloy nanostructures, polymer nanostructures and metal/polymer composite nanostructures.

**Prem Felix Siril & Prasanth P. Jose**

# SUMMER INTERNSHIP PROGRAMME

1.  IIT Mandi organized a 'Summer Internship Program' for Bachelors and Masters students from all over India during June – July 2012. Nineteen interns were selected for this program from a large number of applications received. The participants included students from various Institutes and Universities including IIT Roorkee, Sardar Vallabhbhai National Institute of Technology Surat, S.K. Porwal College Kamptee Nagpur, Pondicherry University, Kakatiya University Warangal, Central University of Bihar, NIT Durgapur, NIT Calicut, IISER Pune, Amity University NOIDA and PUSSGRC Hoshiarpur. Each student's skill set was matched with an appropriate project from the Institute. Students were admitted in the following disciplines:- Chemistry-9, Mathematics-5, Physics-3, Electrical and Mechanical Engg. – 1 each. This internship program was for a period of 8 weeks and the internship included a stipend and housing assistance as well.

2.  Siril PF and Robert P. Ilango (M.Sc. Dissertation 2011-2012, M.S. University, Tamilnadu) – "*A study on energetic material – Synthesis and characterization of α-FeOOH Nanoparticles*" – Presently at Kyung Hee University, South Korea.

3.  Siril PF and Sharma V.(March – Sept. 2012, Amity University, Integrated M.Sc. + M.Tech (Nanotechnology) "*Synthesis of Core shell Au @ PtNanorods by Galvanic Replacement Reaction and their Application towards the Oxygen Reduction Reaction in DMFCs*"

4.  Mr. Florian Schäfer ( DAAD Summer Intern, July- October, 2012, B. Sc. 2nd Year, Mathematics Major, University of Bonn, Germany) - Research Area: Single $C_{60}$ Transistor.

## CONFERENCES/ WORKSHOPS ORGANIZED

1. Kashyap A. First Academia-Industry Interaction Conclave jointly hosted by IIT Mandi and CII (North) May5, 2012.

2. Gonsalves K, Sawhney RC, Nandi CK, Ghosh S, Siril PF, Sinha N.National symposium on Nanobiotechnology (NSNT 2012) June 1-2, 2012.

3. NPTEL to expand education horizon, June 29, 2012.

4. Sao AK. Seminar on Computational Intelligence Applications to Renewable Energy July 9-13, 2012.

5. Short Term Course on "Finite Element Method for Engineering Applications" July 16th-20th, 2012

6. Kashyap A. Meeting of all IIT placement heads at IIT Mandi on Sept 22, 2012.

7. Kashyap A. Beginners Workshop on Android Developmentdates?

8. A Short term course on Computer Aided Drafting for Engineers and Designers will be organized by SE on 4-8th Feb, 2013.

9. Kashyap A. IUATC Workshop, March 8-9, 2013.

## First Academia-Industry Interaction Conclave



The Indian Institute of Technology (IIT) Mandi in collaboration with the Confederation of Indian Industry (CII) organized the first Industry - Academia Conclave on Saturday, 5 May 2012 at the Kamand Campus of IIT Mandi. Prof. T. A. Gonsalves, Director IIT Mandi, and Dr. Arti Kashyap, the Organizing Chair welcomed Academia and Industry to IIT Mandi. The keynote address titled India's Power Crisis and the Potential of Decentralised Solar PV DC Power, was delivered by Prof Ashok Jhunjhunwala, Padma Shree, Department of Electrical Engineering, Indian Institute of Technology Madras. Prof. Jhunjhunwala set the tone for the Conclave by explaining the power crisis in India and

the need to look for alternatives as well as smart solutions, which require the partnership of Academia and Industry. Mr. C. N. Dhar, Chairman, CII HP State Council, and Prof. R. Shrivastava, Director NIT Hamirpur, also welcomed this initiative of IIT Mandi and stressed on the importance of such collaborations between Industry and Academia.

Besides the participation of the faculty and students of IIT Mandi, there were representatives from CII, IIT Delhi, IIT Madras, IIT Ropar, IIT Hyderabad, NIT Hamirpur and SASE Manali. The industry was represented by companies like Microsoft Research, CAD Studio, TCS, ABB, Siemens, Mahindra Swaraj, Altair Engineering, Aricent, Tejas Networks, Sandhar Technology, Benchmark Microsystems, Altruist Technology, Nucleus Software, etc.

Presentations made by faculty showcasing the research expertise of various Schools in IIT Mandi marked the background to panel discussions. After Prof. T.A. Gonsalves' presentation highlighting the vision and focus areas of IIT Mandi, Prof. Kenneth Gonsalves elaborated upon the interdisciplinary research being done in material sciences and engineering. Dr. Vishal Singh Chauhan showcased the research in engineering. Prof. Anand Srivastava discussed several research initiatives in computing, electronics and electrical engineering. The interdisciplinary nature of research at IIT Mandi came into focus time and again via these presentations.

The objectives of this conclave were to showcase the strengths of IIT Mandi to partner the industry, to understand the problems being faced by industry and society in large and their possible solutions. There were four broad panel discussions coinciding with these objectives -- Innovative Product Design by Indian Industry in collaboration with IIT, Can/should IIT produce graduates ready-made for Industry?, Towards a Research Park at IIT Mandi, and IIT Mandi as an R&D Partner for Industry.

**Innovative Product Design by Indian Industry in collaboration with IIT**: The panelists discussed how Indian industry could accelerate its movement towards inclusive growth by pursuing high value addition engineering and product design by collaboration with IIT Mandi. It was concluded that high-end design and IP (intellectual property) generation are essential for Indian industry and that there would be substantial benefits of working with Academia. Prof. Jhunjhunwala emphasized that faculty needs to take the long-term view and work with the industry without worrying about short-term rewards. If they provide value to industry, rewards will come in the long-term.

**Can/should IIT produce graduates ready-made for Industry?**: While Industry wants competence in specific tools and skills used by various companies, Academia prefers to teach broad principles and practices. Can and should this divide be bridged? After the discussion it was felt that Industry wants graduates who have strong fundamentals, who can learn whatever is needed, and who have good communication and inter-personal skills. And Industry itself imparts specific skills during induction training and project-specific training.

**Towards a Research Park at IIT Mandi**: To give a boost to high-tech industry in Himachal Pradesh and J&K, a region that is still largely rural in nature, the panel discussed whether this the right time to initiate a Research Park and what model of Research Park would be appropriate for Mandi. What are the unique opportunities and challenges offered by this location? Prof. Jhunjhunwala outlined the modus operandi of the IIT-Madras Research Park, the first such Research Park in India. Over

40 companies have setup their R&D units in this Research Park and the "credit-based lease" ensures active collaboration with IIT Madras. It was concluded that a Research Park at IIT Mandi is essential since it will spur the industrial development of this Himalayan region, and will build up an industrial ecosystem in Mandi. The Research Park should focus on sectors where IIT Mandi has strengths, such as materials, renewable energy, and innovative technologies for rural Himalayan region.

**IIT Mandi as an R&D Partner for Industry**: The discussion largely focused on what are the mechanisms within the IIT framework for industry collaboration and what are the needs and constraints of industry in working with IIT. How can a common ground be achieved? Many of the industry participants expressed their interest to collaborate closely with IIT in variousways.

## National Symposium on Nanobiotechnology June 1-2, 2012



The National Symposium on Nanobiotechnology was held at IIT Mandi during June 1-2, 2012. The Symposium was inaugurated by Chief Guest Dr S. K. Sharma, Vice Chancellor HPKV Palampur.Invited experts from major universities and research institutes regionally (NIPER, IHBT, HPKV) as well as nationally (AIIMS, Jamia Millia Islamia, AMU, BHU, IISER Pune and IISER Bhopal, DRDO, NPL) delivered state-of-the-art lectures on topics on nanotechnology and related to biology, medicine and agriculture. Specifically, talks centered around the three symposium themes: bioscaffolds/tissue engineering; drug delivery and targeting; bionano interfaces. The symposium began with a pre-conference tutorial for those new to the field, arranged by IIT Mandi faculty and NIPER Mohali. Prof Rajesh Malhotra (MD), AIIMS gave a fascinating talk on the use of nanotechnology in orthopedics. Concluding the technical and poster sessions a panel discussion on practical applications by pharma, clinicians and agricultural experts summed up the roadmap for this emerging field, especially with respect to Himachal Pradesh. Over 120 participants attended this scientific event. Students presented sixty posters on their research in nanotechnology. A significant conclusion to the event was the collective decision of attendees to establish a Bionanotechnology Society with the secretariat located at IIT Mandi. One of the future charges of this society would be to establish a working committee of experts to develop guidelines for safety in nanoscale research and development and ensuing commercial products. A quarterly bulletin will also be released shortly summarizing the achievements of the NSNT. It was decided that collaborations between IIT Mandi and HPKV will be given priority under the ICAR 12th five yearplan on applications of nanotechnology in agriculture, veterinary and food

technology. Another highlight was the focus on the Himalayan region by Dr Sanjay Kumar from IHBT Palampur. Dr Kotnala from NPL Delhi provided guidelines on the role of ethics in this emerging field.

Speaking on the occasion, Prof. Timothy A. Gonsalves, Director IIT Mandi outlined the strengths and vision of IIT Mandi. From the same platform, he invited all institutions in the region for collaborative research with IIT Mandi. The Guest of Honor was Dr Muraleedharan, Director of Materials at DRDO HQR, New Delhi. He provided the wide canvas of nanotechnology applications and future requirements in defence and civil, such as nanobiosensors, drug delivery, medical imaging. Applications in plant technology at high altitudes were also highlighted. Potential collaborations between IIT Mandi and DRDO in nanotechnology were discussed and planned.

## NPTEL to Expand Education Horizon June 29, 2012



The 12-member NPTEL Programme Implementation Committee (PIC) met at IIT Mandi on June 29, 2012. The participants discussed ways to enhance effectiveness of NPTEL's free online courses which aim at improving the quality of engineering education in the country. The Director, IIT Mandi, Prof. Timothy A. Gonsalves and four other faculty members of the institute were special invitees. In his welcome address, Prof. Gonsalves highlighted the significance of NPTEL in the education sector. He recalled that while he was at IIT Madras, he used to be sceptical about distance education and online teaching as compared to classroom teaching. But after coming to the relatively remote Mandi, he realised the vital role of online education. "Through online education, students can access experts in any area and can learn from them," he said.Prof Gonsalves listed various challenges faced while using online resources. First, despite good network facility, the network sometimes goes down from one or both ends. Second, it is difficult to schedule lectures simultaneously among students of different universities that follow different academic calendars and are in different time zones. Third, lectures need to be more interactive as students' attention span shortens when they listen to lectures on their own. Prof. Gonsalves also favoured the

introduction of a certification scheme in NPTEL on the basis of courses taken by students. In his inaugural address, Prof. R. K. Shevgaonkar, Director, IIT Delhi said, "Phases I and II of NPTEL were mostly about content creation. The third phase should concentrate on dissemination of courses and making it available to colleges."

Dr. Bhaskar Ramamurthy said the number of viewers or readers who benefit from NPTEL is far more than other similar online education programmes. Recreating content through the banana-peel approach and good certification procedures would improve scalability. Akash tablets would also help in the spread of online education. Prof. M.S. Ananth pointed out that despite the challenges faced by this initiative, from delayed funding to time taken to coordinating with major universities to design the syllabus, the progress has been commendable. Also highlighted was the need to rope in more experts to create a wider knowledge base. Prof. Mangal Sunder Krishnan, IIT Madras, presented some interesting figures. The number of videos lectures on the NPTEL site has gone up from 3,198 in 2008 to 7,981 in 2012. Increased awareness and pedagogy training would definitely help this endeavour.

It was decided in the meeting to give certification to students taking three courses: Programming, Algorithms and Data Structures. The certification will be open for B.Tech. 3rd Yr. students and graduates in Sciences. The Ministry of Human Resource Development (MHRD) could build certification centres. And later, the certification can be extended to other courses that could eventually be run by a virtual university from NPTEL. A separate meeting of the IIT Directors (VCTEL) would be held soon and may be attended by the MHRD members for putting in place a mechanism for certification.

Currently, NPTEL is involved in higher education. Experts at the meeting suggested that NPTEL could play a fruitful role in high school education as well. IITs can now frame high school course guidelines for it. Topics from CBSE textbooks can be broken into problems and explained. Among those who attended the meeting were Prof. K.R. Srivathsan (IGNOU), Prof. Mangal Sunder Krishnan (IIT Madras), Prof. Bani Bhattacharya (IIT Kharagpur), Prof. K. Gopakumar (IISc Bangalore), Prof. Ashok Raichur (IISc Bangalore), Prof. Kushal Sen (IIT Delhi), Prof. Satyaki Roy (IIT Kanpur), Prof. Pradeep Yammivar (IIT Guwahati), Dr. Kandasamy (NITK Surathkal) and Dr. Ramesh (VTU).

## Seminar On Computational Intelligence Applications To Renewable Energy (CIARE-2012) July 9-13th, 2012

The Seminar was inaugurated by Prof. Lalit Malhotra, acting director of IIT Mandi, Prof. Subrata Ray and Prof. B. Subramanian in academic block of IIT Mandi. In his inaugural address, Prof. Malhotra highlighted the accomplishment and research activities of IIT Mandi. While sharing the vision of IIT Mandi, as an Institute 'to be a leader in science and technology education, knowledge creation and innovation, in an India marching towards a just, inclusive and sustainable society' and one of its thrust area 'to devise globally recognized solutions for the problems of society and industry, particularly in the fragile eco-system of the Himalayas', he emphasized the relevance of this timely Seminar that has provided the platform where different groups of the society can come

together to solve the challenges of 'green energy' for a sustainable society. Prof. Ray addressed the gathering by highlighting the need of integrated research planning for energy as well as natural resources in India. Prof. Subramanian shared the philosophical views on word Energy for wider means.

The main objective of this Seminar was to facilitate a discussion about the applications of various Computational Intelligence (CI) techniques and their suitable applications to the renewable energy related problems for efficient grid integration in smart grid environment. The various issues, problems and challenges of the electric grid operation, management and control with high penetration of RES were also discussed. The power systems are changing very rapidly due to the new technological developments and formulation of new regulatory polices of the governments.Earlier, addressing the participants, Seminar coordinators Dr. B. S. Rajpurohit and Dr. Anil Kr. Sao emphasized the development of various technological and regulatory solutions to counter balance the intermittency and high price of RES like small hydro energy, wind energy, solar energy etc. specially for Indian power sectors. Seminar coordinators said that meaningful discussion in such august gathering would definitely lead to enrichment of all the participants and will carry the message throughout the society. This Seminar drew more than 35 participants from academic institutions, power utilities and industries from different states including UP, Punjab, Tamilnadu, Maharashtra, Delhi, Haryana, Rajasthan, Himachal, Andhra Pradesh, and Uttarakhand.

Prof. Ashwani Chandel from NIT Hamirpur, Dr. N. M. Pindoriya from IIT Gandhinagar, Er.V. K. Agarwal from NLDC, Er.Pavan Kohli from HPPCL Mandi, Er. Bandanjot Singh from National Instruments and Dr. Umakant Dwivedi from RGIEPT were among the speakers. A field visit to Dehar Power House (900 MW) at Slapper, Distt. Mandi was also arranged.

## Short Term Course on "Finite Element Method for Engineering Applications" July 16-20, 2012



A one week short term course on 'Finite Element Method for Engineering Applications' organized by Indian Institute of Technology Mandi during July 16-20, 2012. The course was inaugurated by Prof. T. A. Gonsalves, Director, IIT Mandi, Prof. Subrata Ray, Prof. Lalit Malhotra, Dr. R. C. Sawhney and Dr. Manish Shrikhande in academic block of IIT Mandi.On the occasion, Prof. T. A. Gonsalves spoke about the advantages of employing computer-based techniques for designing and research. Talking about the faster designing process, he also cautioned the students against blind over-reliance on softwares that could lead to accidents.Prof. Malhotra highlighted the accomplishment and research activities of IIT Mandi and shared the vision of IIT Mandi, as an Institute to be a leader in science and technology education, knowledge creation and innovation. Prof. Ray addressed the gathering by highlighting the need of modeling and simulation. Dr. R. C. Sawhney shared the technical views on research.The main objective of this 5-days short term course was to introduce the fundamentals of finite element method to the participants to solve problems in different engineering disciplines viz. solid mechanics, structural dynamics, fluid mechanics, heat transfer, and electrical circuitry network and to familiarize the participants to programming utilized in implementing the Finite Element method.Participants were awarded the certificate of participation by the Director of IIT Mandi, Prof. Timothy A. Gonsalves

The participants, who came from both academia and industry, appreciated the short course. Student participants from Institutes like IIT Roorkee, NIT Hamirpur, Jabalpur Engineering Colleges, etc. acknowledged the edge this course would provide them either in their research work or in understanding the inter disciplinarily involved in problem solving.The interactive sessions during the course were also welcomed by many students.

The speakers included Prof. Puneet Mahajan (IIT Delhi), Dr. Manish Shrikhande (IIT Roorkee), Dr. I. V. Singh (IIT Roorkee), Dr. Rajeev Kumar (IIT Mandi), Dr. Vishal Singh Chauhan (IIT Mandi) and Dr. Om Praksh Singh (IIT Mandi). The short-term course came to an end on July 20, 2012. Candidates were awarded the certificate of participation by the Director of IIT Mandi Prof. Timothy

## A Short term course on Computer Aided Drafting for Engineers and Designers organized by School of Engineering during 4-8 Feb, 2013



The School of Engineering, IIT Mandi, from February 4, 2013, organized a short-term course of one week on Computer Aided Drafting for Engineers and Designers. The course drew 32 candidates from organizations like DRDO, Irrigation & Public Health Department, as well as the industry and the academia. Prof. Kenneth Gonsalves, Prof. B. K. Mishra, Dr. Pradeep Parameswaran and Dr. Vishal S. Chauhan inaugurated the course in the academic block of IIT Mandi.In the inaugural speech, Dr Pradeep parameswaran informed the participants about the Institute's vision and achievements. Next, Prof. Ken Gonsalves, visiting professor at IIT Mandi, spoke about the research development activities in nano/microfabrication for electronics as well as in bio-nanotechnology, and that IIT Mandi would be among the few IITs to have a cleanroom facility.

Prof. B.K. Mishra from IIT Roorkee underlined the importance of Computer Aided Drafting in the field of engineering and design. He then introduced the participants to the basic fundamentals of drafting and designing. The short-term course covered part modeling, assembly modeling and computer aided engineering drawing in various field of engineering (i.e. mechanical, civil, chemical, electrical, electronics and architecture). The participants found the course very effective and appreciated the instructors' helpful attitude. The speakers included Prof. Sunil R. Kale (IIT Delhi), Prof. B. K. Mishra (IIT Roorkee), Dr. Rajeev Kumar (IIT Mandi), Dr. Vishal Singh Chauhan (IIT Mandi), Dr. Om Praksh Singh (IIT Mandi). Ar. Nitin Gautam (Build Con Pvt Ltd New Delhi) and Er. Sushil Suril (Solid Works Corporation New Delhi).

The course concluded with certificate distribution by the Director of IIT Mandi, Prof. Timothy A. Gonsalves. While addressing the participants, he said, "Short-term courses are means to expose the audience to the wide range of applications in the area and about different methodologies to tackle real life problems". Dr. Rajeev Kumar and Dr. Vishal Singh Chauhan were the coordinator and co-coordinator respectively of this short-term course.

## IU-ATC Workshop to promote 'Digital Economy' MARCH 8-9, 2013



A two day workshop of the India-UK Advanced Technology Centre (IU-ATC) of Excellence in Next Generation Networks, Systems, and Services was held during March 8th-9th, 2013. This workshop titled "8th Indo-UK Technical Workshop on Next Generation Network Systems and Services" was the first international workshop held at the new Kamand Campus of IIT Mandi. About 30 participants came from UK, with about 50 from various parts of India. The valedictory address for this workshop was delivered by Dr. M. M. Pallam Raju, Hon'ble Minister for Human Resource Development, Government of India, in the afternoon on 9th March, 2013.

IU-ATC aims to develop next generation wireless technologies tailored to the Indian needs. This consortium is simultaneously developing low-cost applications using wireless networks to serve the needs of the masses, especially in rural India. The main purpose of the workshop this year has been to reflect on the research work done to date since the last workshop at Cambridge University, UK; and, to take on board further recommendations from funding agencies, which include the Department of Science and Technology-DST (India) and the Engineering and Physical Sciences Research Council-EPSRC(UK).

IU-ATC is by far the largest consortium for collaborative research between UK and India including nearly 200 researchers (students, faculty, postdocs, and industry researchers) from India and UK. This consortium has helped create a network of Indian and UK scientists of a magnitude that did not exist up to now. The IU-ATC is the first large multi-institution, cross-continent project involving academia in India and UK coupled with active industry participation. Currently, the consortium comprises of nine leading research universities in UK, six IITs and the IISc, R&D organisations and major industrial partners in UK and India, and a number of small and medium enterprises.

From the U.K. side, the University of Ulster in Northern Ireland is the lead institution in IU-ATC. Eight other research-based UK universities form a part of IU-ATC: University of Surrey, Lancaster University, Queen Mary University of London, Southampton University, University of St. Andrews, University College London, University of Bristol, and the University of Cambridge. From the Indian side, IIT Madras is the lead institution and it is joined by five other IITs (IIT Delhi, IIT Bombay, IIT Mandi, IIT Kanpur, and IIT Hyderabad), IISc Bangalore and two R&D organisations IIT-M's RTBI and CeWIT. Companies in the consortium include: BT, Toshiba, Infosys, Wipro, and Sasken among others. The IU-ATC aims to provide a holistic approach to next generation wireless networking

technologies, from the physical layer to the network protocols, and applications on such networks that are relevant especially to rural India. With this focus, current research in IU-ATC is divided into three high-level areas: Applications and Services; Core Network Systems and Protocols; and, Heterogeneous Wireless Access Networks.

These three research areas within IU-ATC are focused on promoting a "digital economy" that aims to support research and skilled people to effect early adoption of Information and Communication Technologies (ICT) by a variety of user sectors. The IU-ATC research areas are not standalone, but rather they encourage inter-area exchange and sharing of deliverables. This ensures that research test-beds provided by academic and industry partners are coordinated and managed to provide the maximum benefit for the individual research areas and for the project as a whole.

Some socially relevant projects under IU-ATC include E-Agri, E-Health, E-Education, and Emergency Services. The E-Agri project aims to develop technologies that will help connect farmers with experts who would be providing them with much needed farming information. This project also provides experts the tools by which they can quickly and easily search for the latest and relevant information. E-Health involves developing a computer-to-patient voice communication over low-end mobile phones for follow-up after initial treatment. E-Education involves developing a "virtual classroom for education." The Emergency Services deals with developing an end-to-end system to manage effective delivery of services in case of flood, fire, and other emergencies. These applications are currently being developed at the IIT Madras' Rural Technology and Business Incubator (RTBI). Some of these applications will be deployed in Himachal Pradesh in the coming months by IIT Mandi. An over-arching activity will explore and develop technical solutions to provide scalable wireless and fixed access to Cloud-Computing resources in support of these applications. The whole area of Cloud Applications and Services is important across both the Indian and British governments.

# CENTRAL LIBRARY



Central Library has been playing a vital role in furthering the academic and research mission of IIT Mandi and facilitates creation and dissemination of knowledge. Library provides essential support by offering current library services which are integrated with teaching, learning and research activities. The Library facilitates excellence in teaching, creates an appropriate learning and research environment, anticipates and responds to student learning and research needs, and provides the information infrastructure essential in today's changed environment.

The library has been rapidly developing its collection of books, reference books, reports, periodicals, and electronic resources. The Text Book Collection in the Library provides vital supports for on-going undergraduate teaching programs. The books are on various disciplines ranging from Computer Science Engineering, Mechanical Engineering, Electrical Engineering, Mathematics, Physics, Chemistry, Economics, and Philosophy. The collection for Post Graduate programs is also being developed simultaneously.

Central Library provides access to the various e-journals databases. This includes access to hundreds of journal titles each on subjects such as Mathematics, Chemistry, Physics, Computer Science, Electrical Engineering, Mechanical and Astronomy. The library is completely automated by using open source library management software *KOHA*. All documents are bar-coded and by retro conversion all collections acquired prior to automation are also included in the Central Library book database. Transaction of books is also automated. Library has introduced various innovative services including CAS/SDI, on-line renewal of books etc. By using Web OPAC, users can check their borrowing details online. A workstation has been set up for users to access library holdings.

**Software Used in Library:**

    **(I)**    **KOHA:** For automation purpose.

    **(ii)**    **DSpace**: For digitization purpose.

**(iii)** **Greenstone:** For digitization purpose.

**(iv)** **Linux:** For operating system.

## Collection Development and Management

Collection building has become one of the important functions of the library that supports academic and research work of the students, faculty, staff, and other users. Library collection comprises of books, journals, reports, pamphlets and other reading material in science, engineering, technology, humanities and social sciences.

### Print Documents added during the year 2012-13

In the period of 2012-13, Central Library acquired 1556 books including 18 reference books. It also added few periodicals/magazines, besides reprints, technical reports and annual reports of other universities/institutions.

A list of new additions of books is issued every week and can be accessed on the library home page. This list is also circulated by e-mail. An email alert is also sent to the requesting faculty members(s) about the arrival of publications requested by them.

### New electronic resources subscribed during the year 2012-13

The Central Library provides web-based access to the following e-resources:

- **Full-text e-journals:**
  Access to 10000 + full-text journals from the following databases:
  ACM Digital Library, ACS, APS, ASME, Elsevier's Science Direct, IEEE Electronic Library, JSTOR, Springer Link, Taylor & Francis (S&T complete Collection), Nature, Annual Reviews etc.

- **Bibliographic e-databases**:
  SciFinder, MathSciNet, SIAM all e-journals & Web of Science.

- **e-Books**:
  Central Library provides access to a collection of more than 2800 e-Books in various disciplines. The e-book collection contains the tittles which are a rigorous recommendation by the subject experts of the institute and cater to the needs of the users. The publishers of e-books collection include Science-Direct (Elsevier), McGraw Hill, Pearson, T&F, IEEE, CUP, ASME, World Scientific and John Wiley.

The process of e-book collection development for this year has already been started. Efforts are being made to include the book collection of other renowned publishing houses.

### Circulation

Circulation activities have been now automated. Library users can check their borrowing details by using WebOPAC. We serve the users consisting of the faculty, research scholars, students and staff. Circulation service is kept open for 50 hours a week. On an average, the monthly circulation transactions are about 1600.

### Digital Library

Central Library has its own homepage (http://www.iitmandei.ac.in/academics/lib/), which provides

web-based access to its resources, procures over 10,000 electronic journals and databases. An institutional repository of publications has recently launched which provides access to the intellectual output of the IIT Mandi community. The library is a part of the institute-wise network and has adequate computing infrastructure to cater to the needs of the users.

**OPAC (On-line Public Access Catalogue)**

The OPAC is one of the most heavily used database of the library and is accessible 24*7 via library web page (http//www.webopac.iitmandi.ac.in/). Besides listing all the documents available in the library, it allows on-line renewal and reservation, circulation and indicates status of a particular book. OPAC is searchable by author, title, accession number, subject and several other fields.

**INDEST Consortium**

Under the INDEST consortium, Central Library, IIT Mandi has received access to the following resources:

- Annual Reviews (All e-journals)
- Nature (27 e-journals)
- MathSciNet

**Services Offered**

- Fully automated Circulation
- Online book reservation, Information search, Patron's library book loan status check
- Web OPAC (Web based Online Public Access catalogue)
- Reserve collection development for student's in-house reading
- New Arrival Book Section
- Reference Service
- Inter-Library Loan
- Document Delivery Service
- Information Alert Services
- Selected e-resources subscription for Central Library
- Digital library services
- User education program

*Future Plans:*

- *Implementation of RFID Tags.*
- *Database for Table of Content Pages of Library Books.*
- *Database for Institutional Repository.*

Database of different software available with CDs/DVDs available in the Library.

## B. Tech IInd year students shift to Kamand campus

IIT Mandi is now first among the new IITs to have academic and residential facilities on its main campus at Kamand. In a historic move, 108 B.Tech IInd year students shifted to their new hostels on September 23, 2012.

The Dining Hall was formally inaugurated by the warden of the Hostel, Dr. Venkat Krishnan in the presence of the Director, faculty, staff and students. A table tennis room inside the building and the kitchen were also inaugurated next by students, Apoorva Bhatia, Runa Barik, Reena Singh and Chamundeswar. The inauguration was followed by the first lunch prepared in the kitchen of the new hostel.

The classes of this batch are now taking place in the newly setup class-rooms and laboratories on the main campus itself.

## Accommodation

Students are provided accommodation in seven different hostels:

- Suvalsar near Academic Block - 1st Year boys
- Beas Kund Hall: for MS/PHD students
- Dashir at Jail Road - 2nd and 3rd Year boys
- Renuka Hall- in the Annexe - girls
- Chandra Taalin the Annexe – girls
- Saulikhad: 1st Year boys

Prashar: Prashar hostel is the first permanent hostel in the institute's main campus in Kamand

## Financial assistance and scholarship

All possible efforts are made by the Institute to render financial assistance in the form of scholarships to needy and deserving students during their stay at the Institute. The institute is providing financial assistance to the students through the following schemes:

Merit cum Means Scholarship.
HTRA scholarship for Ph.D and MS Scholars.
Financial Assistance & Scholarship to SC / ST students.
Central Sector Scholarship for SC Students.

During the period 2012 – 13, Rs. 72,46,461/- as Scholarship to One Hundered Thirty Nine (139) B. Tech students including General, SC, ST & OBC students has been provided under the different schemes.In addition SC/ST students have been benefited by way of waiver of tuition fees to the tune of Rs. 50,80,000/-.

MS & Ph.D students are also facilitated with scholarships. During this period Rs. 14,96,716/- as scholarship was awarded to twenty MS students and Rs. 95,79,872/- to sixty seven Ph.D students.

## Student Societies

At IIT Mandi, students are encouraged to develop themselves as all-rounder. A diverse array of extracurricular opportunities are available for this. Cultural activities are managed by different student societies. The major student activity sections are:

- Web Design Club
- Choreography Club
- Magazine
- Programme Management
- Music Club
- Dramatics Club
- Information Management Group
- Sports / NSO
- NSS
- English Debating and Literary Society
- Robotics Club
- Hiking and Trekking

## Sports activities during 2012-13

IIT Mandi has successfully developed various sports facilities within a very short span. Outdoor facilities for Football, Hockey, Cricket, Basketball, Volleyball, Lawn Tennis and indoor facilities for Badminton, and Table Tennis are in place. The Volleyball and Basketball grounds are equipped with flood lights. Various indoor facilities are also available in the hostels. Skilled and experienced coaches are available for all sports events. Students are motivated for sports activities through NSO. Sports council organized a number of tournaments like Inter branch, Inter year, and Inter hostels to encourage students' sports activities. This year IIT Mandi  Badminton (Boys & Girls), T.T. (Boys & Girls), Volleyball and Chess teams were participated in UDGHOSH'12 (Sports Festival, IIT Kanpur).

## Inter Branch Sports Tournament-RANN'12

Sports council of IIT Mandi organized the first ever official tournament, RANN'12 (Inter branch Sports Tournament) on 19th October, 2012. The events were Football, Volleyball, Basketball, Badminton, Table Tennis and Chees. The tournament was concluded on 21st October with a prize distribution ceremony in the multi-purpose hall. The ceremony started with the speech of our honorable director, Prof. Timothy A Gonsalves followed by the prize distribution to the winners.

IIT Mandi team participated in Inter IIT sports meet 2012 held at IIT Roorkee from 16$^{th}$ -24$^{th}$



*Inter IIT Sports Meet 2012*

December, 2012. There were total contingent of 107 students including 12 girls and 95 boys. In spite of being a new IIT, our students participated most of the sports events organised in the tournament. IIT Mandi cricket team has reached semi-final after beating old IITs. Faculty and Staff team consisting of 18 members was also participated in the Inter IIT Staff Sports Meet 2012. It was

held at IIT Roorkee from 27th – 30th December, 2012.

The inter hostel and inter branch sports competitions were also organized.



## National Service Scheme (NSS)

The NSS unit at IIT Mandi encourages students to understand the immediate society and to search the meaning of life through the spirit of social services. It provides students different opportunities to take part in several voluntary initiatives.

**The major activities of NSS Unit IIT Mandi have been:**

**Literacy program**

During the year 2012-13 NSS unit at IIT Mandi continued its literacy program. The Literacy team visited various local schools of Mandi and nearby areas and provided the students with necessary guidance and assistance regarding their preparation for JEE/AIEEE/PMT and other such competitive entrance examinations. The Literacy team went to GSSS in Pandoh and Sen. Sec. School Kamand and created awareness among students about higher education and provided them career guidance. Students had meetings with parents and teachers in Kamand to know about their problems and gave suggestions to solve them.

**Blood donation camps**

NSS unit organized two blood donation camps and both were very successful as we collected more than 150 units of blood could be collected. These camps were organized in our Mandi campus.

**Cloth collection campaign**

This was initiative of one of our students and a good amount of clothes was collected and distributed amongst the needy people.

**Inspiring students**

Our NSS members went to some schools and inspired them about IIT and other fields of career. This idea was also taken to 'IIT Roorkee Fest' by our students who participated there and brought laurel to the institute.

**Plantation in Kamand**

Plantation in Kamand campus was done by the students of 2nd year when they shifted there

permanently .This was an initiative to make students aware about the  importance of plants and trees in our life.

**Visit to food processing plant, Nagwain, Kullu**

We visited Nagwain to a food processing plant where we visited last year too. This year it was more advanced. They taught NSS members how to preserve fruits and in return they solved their technical problems.

**Archiving Mandi Shivratri**

NSS Unit IIT Mandi has started a project called "Archiving Mandi"last year. The project intends to develop a visual archive which mirrors the town's rich customs, traditions and ways of life. The purpose of this project has been to develop a visual database on Mandi's history, economy, society and religious life. This year NSS extended it to the international fair of Shivratri being held in Paddal ground in Mandi.

# Hiking and Trekking Club

For an IIT in the lap of the Himalayas, a full-fledged Hiking & Trekking Club caters to the spirit of adventure that resides in the students of IIT Mandi. Himachal Pradesh is one of the most beautiful



places on earth. Places like Parashar, Rewalsar, Kamand, Manikaran etc. are ideal for hiking. Nature truly signifies its beauty in these set of mountains where our institute is situated. With the Director himself having keen interest in hiking, the club arranges trips on regular basis for its members to various places. Hiking and Tracking Club of IIT Mandi is the single largest club at IIT Mandi. Students, Staffs and Faculties are the members of this club. More than 150 members registered in this club during 2012-2013. During the period 01st April, 2012 to 31st March, 2013 the club had carried out many full-day or Half-day long hiking and trekking activities. The members trekked to Prashar Lake, Naina Devi Temple, Shikari Devi Temple and to the hill tops adjoining to the South Campus.

# Exodia-2013, a big hit
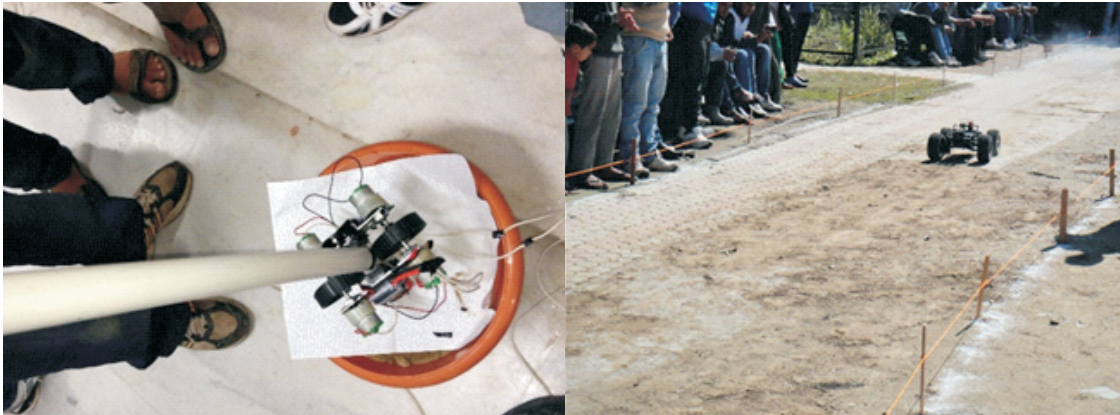


Keeping up with the tradition, Exodia-2013, tech-cum-cult fest organized by the students of IIT Mandi from March 1st-March 3rd was a big hit with the audience this year too. Around 550 students took part in the fest from the reputed technical Institutes from all over India like IIT Kanpur, IIT Ropar, IIT Hyderabad, bits Goa and so on. The fest was a right mix of cultural, technical and literary events. The band of Ex-euphoria member, Eka; Kathak performance by Monisa Nayak, Mr and Ms. Exodia and musical show by you tube artistes were some of the highlights of the fest.



It was a sheer treat to watch the cultural show organized during Exodia that included band slam, alap, instrumania, big stink, envision (documentary-making contest) , synchronians (group dance), groove fanatics (solo dance) and so on. In brand slam musical bands from different parts of the country participated whereas alap was a solo singing contest which attracted around 30 participants. Instrumania gave an opportunity to the students to exhibit their talent in playing musical instruments like guitar, flute, tabla, dhol and so on.

Various literary events like: the big question, survivor, biggest liar and devil's advocate very well exhibited students' speaking and argumentative prowess. The participants put their arguments logically with apt choice of words.

Several tchnical events like contirve, junkyard wars, designots, pneumatic missile, dementia, obfuscation, quick thesis contest, clash of avatars (sumo), escalade and nitroblaze as part of Exodia helped the creative minds to innovate and design running models.

## Career and Placement Cell



Placement associated activities are handled by the Career and Placement Cell (CnP). The CnP consists of faculty, staff and student volunteers working to help students get internships and jobs. The placement session for the batch of 2013 marked the onset of IIT Mandi into the fray. With the recently concluded placement session of its first ever batch of B. Tech students IIT Mandi has risen to the challenge of hosting reputed organization of the world at its campus and providing students with job opportunities across various sectors and profiles. Beginning with a batch of 96 students we achieved nearly 85% placements with an average package of 7.7 lakhs per annum across all the disciplines. Highest package being offered is 18 lakhs for CS Branch. Despite the uncertain economic environment, our remote location and our own unconventional schedule close to around 50 reputed companies showed interest in recruiting from IIT Mandi and about 30 companies made final offers including big names such as Amazon, HPCL and Microsoft. Six to eight weeks industrial internship during third year is a mandatory requirement in IIT Mandi curriculum. All students go to reputed industries to do their internships.

The first batch of students of IIT Mandi, has reasons to cheer as companies have already recruited 43 sudents.In the first and second round, 25 B.Tech. students of the Computer Science branch, 14 of Electrical Engineering and two of Mechanical Engineering have received placement offers. It giant Microsoft has offered a package of Rs. 16.2 Lakh each to Raj Kamal Singh, Samrat Gavale and Sumeet Singh Arora. Two MS students, Sujeet Kumar and Srimanta Mandal, have bagged job offers from Samsung, Microsoft, Cisco, Google, Samsung, Infosys, Cognizant, Finisar and Nucleus have visited the campus. More companies are coming in the next round. The Institute expects that most students will have jobs offers in hand soon.

### Ground breaking ceremony at Kamand campus

On April 13, 2012 Director, IIT Mandi, Prof. Gonsalves performed the ground-breaking ceremony at the Kamand campus in the presence of various faculty members and the administrative staff. The ceremony organised by M/s Ahluwalia Corporation began with a hawan, followed by the ground breaking and a high tea. CPWD has formally awarded the contract to M/s Ahluwalia Contracts (India) Ltd. Mr. Saini, Vice President of Ahluwalia Contarcts promised that the first few buildings of the South Campus will be ready by July. They expect to have up to 250 workers on the job at peak times.

### IIT Mandi Director shifts to Kamand campus

On June 26th, IIT Mandi Director Prof. Timothy A Gonsalves shifted to Kamand, 15 kms from the transit campus in Mandi city. After the ribbon-cutting ceremony by Mrs Priscilla Gonsalves, the IIT Mandi Director occupied his office in the renovated Hospital of the Animal Husbandry Department. As the building now has the conveniences of modern life, his first act was to send an email via the 100 Mb/s optical fibre connection to the Internet. Professor Gonsalves, his wife Mrs Priscilla Gonsalves, their dog Rusty and a PhD scholar Reena Singh are among those who have shifted to the beautiful and serene campus at Kamand. They are residing in renovated staff quarters overlooking the Uhl River. The shift is definitely a step towards speeding up of ongoing activities at the new campus. The second -year B.Tech.students would be the next to move to the Kamand campus in the forthcoming academic session starting in August 2012. The Director has set an example by being the first one to shift, which will motivate other faculty and staff to join him at the Kamand campus soon. The entire Institute is expected to operate from Kamand by July 2013.

# IT Mandi celebrates Fourth Foundation Day

IIT Mandi celebrated its Fourth Foundation Day on February 24, 2013. The day was commemorated with various sports events, cultural activities, and award ceremony for students, staff and faculty and a Dham (traditional Mandi food) for all.On the occasion, the Director, IIT Mandi, Prof. Timothy A. Gonsalves, recounted the accomplishments of IIT Mandi in the short span of four years which included being the first new IIT to have academic, research and residential facilities on its permanent campus at Kamand. He added that the linear model of developing IIT Mandi's Kamand campus in the green, rustic and remote river valley of Uhl is apt. The chief guest on the occasion, Prof. H. Schweppe, Visiting Professor IIT Mandi, distributed the certificates and trophies to students, staff and faculty members as recognition of their exemplary performances.Students, staff and faculty members actively participated in sports like volleyball matches and tug-of-war. B.Tech.students presented a dance and staged a small play on the role of society in fighting AIDS.

# New Buildings inaugurated at Kamand campus



Inauguration of A2 Academic Block by Sh. M. Pallam Raju Hon'ble HRD Minister, Govt. of India

The new buildings in the Kamand campus of Indian institute of Technology Mandi (IIT Mandi) were formally inaugurated by the Hon'ble Minister for Human Resource Development, Dr. M. M. Pallam Raju, on 9th March, 2013. Shri.Virbhadra Singh, Hon'ble Chief Minister, Himachal Pradesh presided over the function. Other dignitaries gracing the occasion included: Shri M. Natarajan, Chairman, Board of Governors of IIT Mandi; Shri. Kaul Singh Thakur, Hon'ble Minister for Health & Family Welfare, and Shri. Anil Sharma, Hon'ble Minister for Rural Development, Panchyati Raj & Veterinary, Himachal Pradesh.

As part of the ceremony, Dr. Pallam Raju inaugurated the newly constructed "Advanced Materials Research Centre". This building will house labs and sophisticated instruments worth about Rs. 20 crores for designing and studying novel materials. Researchers will investigate the basic structure of materials, and develop novel materials for electrical, electronics, biological, and other applications. It will be used by about 40 postdocs and PhD scholars led by an inter-disciplinary team of 15 faculties, including two Distinguished Visiting Professors: Prof. K.E. Gonsalves from the University of North Carolina-Charlotte, and Prof. Subrata Ray, formerly with IIT-Roorkee.

Inauguration of B3 Hostel Block by Sh. Virbhadra Singh, Hon'ble Chief Minister of H.P.

In addition, the Chief Minister inaugurated the "Prashar Hostel" building, a newly constructed student hostel at Kamand. The hostel buildings, patterned after the Himachal village architecture, have a number of architectural features to make them a home away from home for the students. The buildings have insulated double walls and roofs, and double-glazed windows. This is designed to protect the students from the heat of summer and the chilling cold of the Kamand winters.

Also, as part of the day's celebrations, Dr. Pallam Raju gave a valedictory address to the India-UK Advanced Technology Centre (IU-ATC) workshop. IU-ATC is the largest India-UK ICT research collaboration, which employs 200 scientists in both the countries. The workshop brought scientists from India and UK in a two day event to discuss progress on the project that focuses on advanced telecommunication networks and multimedia services.

# 64th Republic Day Celebrations



IIT Mandi celebrated the 64th Republic Day with patriotic fervor and traditional gaiety in front of the Academic Block in Mandi and at its main campus at Kamand.

It was for the first time that the R-Day function was organised at its permanent campus at Kamand. On the occasion, the guest of honour, Mrs. Priscilla Gonsalves, hoisted the National Tricolour and took salute by the security personnel in the presence of faculty members, staff and M.S., Ph.D. and B.Tech. students.The Tricolour was also unfurled in the Academic Block of the transit campus in Mandi by Prof. Lalit Malhotra in the presence of the Deputy Registrar, Mrs. Lalita Sharma, faculty members and staff. On the occasion, he said, "The Republic Day should not be observed as a mere ritual but everyone should take an oath to accomplish their work with perfection to realise their dream of a progressive and developed India."

The event left everyone with the strong determination to excel in their respective fields for the welfare of the nation.

# Our upcoming campus at Kamand



Faculty & Students blocks at South Campus
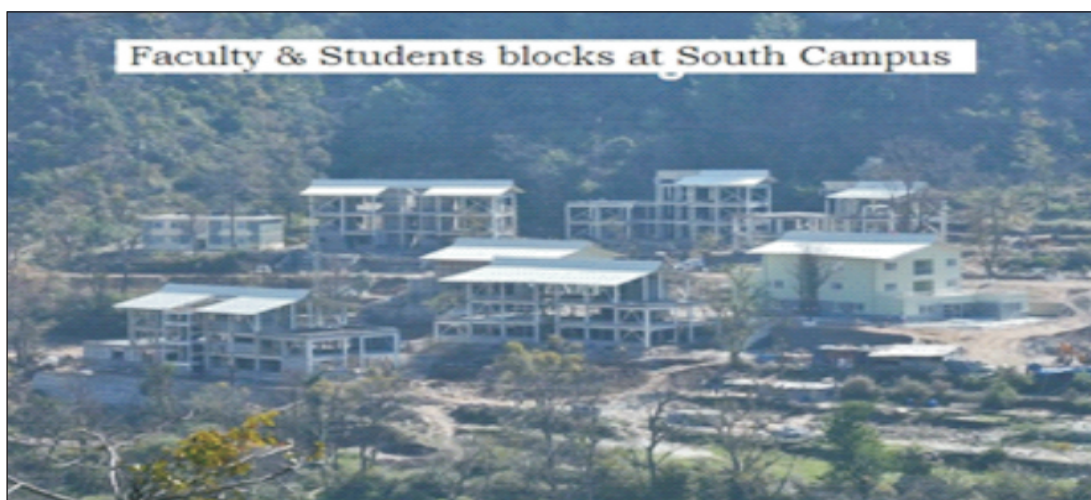


Renovation of the dilapidated animal husbandry buildings at Kamand Campus was carried out to convert these structures into Mechanical Engineering Workshop, PC Lab, Physics and Chemistry Labs and 120 seat Electronic class room connected to National Knowledge Network. Sixteen flats were renovated for use as facility/staff residence. Four student Hostels which could accommodate 150 students were constructed. A new Dining Hall and Permanent pre feb building as an Academic block was also constructed. The construction of additional Academic blocks, Student hostels, Research Laboratories and Residential flats was also started.

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Former Scientific Advisor to
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Registrar
Indian Institute of Technology Mandi
Mandi – 175001

*During this year meetings of the Board of Governor were held on 26/05/2012 & 17/11/2012*

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& Secretary, DRDO, Thiagaraja Nagar
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Department of Secondary & Higher
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New Delhi – 110 001

**Mr.  A. N. Jha**
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Department of Ocean Engineering
Indian Institute of Technology Madras
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## Secretary
**Dr. R. C. Sawhney**
Registrar
Indian Institute of Technology Mandi
Mandi – 175001

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*During this year meetings of the Finance Committee were held on *26/05/2012 & 17/11/2012*

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**Er. Rajan Kapur**
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Mandi – 175001 (HP)

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**Dr. R. C. Sawhney**
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Indian Institute of Technology Mandi
Mandi – 175001(HP)

*During this year meetings of the B & W Committee were held on *21/05/2012,16/11/2012, 05/02/2013 & 14/03/2013*

# AD-HOC SENATE

## Chairman
Prof. Timothy A. Gonsalves, Director, Indian Institute of Technology Mandi (HP)

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Prof. B. Subramanian, Head & Visiting Professor, IIT Mandi
Prof. Arghya Taraphder, IIT Mandi
Prof. Kenneth E. Gonsalves, Visiting Distinguished Professor, IIT Mandi
Prof. Anand Srivastava, Visiting Professor, IIT Mandi
Prof. B. K. Mishra, Dean (Planning) IIT Mandi
Dr. Sukumar Battacharya, Head & Associate Professor, IIT Mandi

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Prof. Kalyanmoy Deb, ME, IIT-Kanpur
Prof. Subrata Ray, MM, IIT-Roorkee
Prof. Tashi Nautiyal, Phy, IIT-Roorkee
Dr. Aalok Mishra, Phy, IIT-Roorkee
Prof. Mala Nath, Chy, IIT-Roorkee
Dr. P.P. Thankachan, Chy, IIT-Roorkee
Prof. Amalendu Chandra, Chy, IIT Kanpur
Prof. S. Vasudevan, Chy, IISc, Bangalore
Prof. R.C. Mittal, MA, IIT-Roorkee
Prof. S. Sundar, MA, IIT-Madras
Prof. Shormishtha Panja, English, Delhi Uni.
Prof. Nauriyal, HSS, IIT-Roorkee
Dr. K. Srilata, HSS, IIT-Madras

Dr. A. Thillai Rajan, Management Studies, IIT-Madras

**School of Computing and Electrical Engineering**
Dr. Anil Kumar Sao,
Assistant Professor, IIT Mandi

**School of Engineering**
Dr. Vishal Singh Chauhan,
Assistant Professor, IIT Mandi

**School of Basic Sciences**
Dr. Prem Felix Siril,
Assistant Professor, IIT Mandi

**School of Humanities and Social Sciences**
Dr. Ashok Kumar Mocherla,
Assistant Professor, IIT Mandi

**Student General Secretary**
Mr. Saurabh Jain & Mr. Sanchit Khattry

**Student Academic Affairs Secretary**
Mr. Deepak Sharma

**Student Research Affairs Secretary**
Ms. Reena Singh & Mr. Hemant Jalota

## Secretary
Dr. R.C. Sawhney, Registrar, IIT Mandi

## ACADEMIC OFFICIALS

**Prof. Timothy A. Gonsalves**
Director

**Prof. B. Subramanian**
Head School of Humanities & Social
Sciences

**Prof. B. K. Mishra**
Dean, Planning

**Prof. Lalit Malhotra**
HoD, School of Basic Sciences

**Dr. P.C.Parmeswaran**
Convenor Execom (Courses)

**Dr. Vishal Singh Chauhan**
Convenor Execom (School of Engineering)

**Dr. Bindu Radhamany**
Convenor Execom (Research)

**Dr. Subrata Ghosh**
Convenor Execom (Students)

## ADMINISTRATIVE OFFICIALS

**Dr. R. C. Sawhney** - OSD & Registrar

**Ms. Lalita Sharma** - Deputy Registrar
(Admn)

**Mr. J.R. Sharma** - Finance & Accounts
Officer

**Dr. A.K. Singh** - Asstt. Registrar (Store &
Purchase)

**Mr. C.L. Sharma** -
Asstt. Registrar (Audits &Accounts)

**Mr. D.R.Verma** - Officer on Special Duty
(Admin)

**Mr. R.S.Raghav** - Technical Superintendent

**Mr. Nirmal Singh Boonga** -
Technical Superintendent

**Dr. Ghanshyam Kapoor** -
General Duty Medical Officer

**Mr. Birbal Ram** - Deputy Security Officer

**Mr. Kaul Singh** - Physical Training Instructor

**Ms. Lishma Anand** - Counsellor

**Ms Ashwini Singh** - Media Consultant

**Er. Anil Kumar Jain** - Senior Consultant

**Sh. Pavin Samuel** - Assistant Administrator

**Sh. Daulat Ram** - Field Supervisor

## Permanent Staff as on 31/03/2013

| Sl. No. | Name | Designation |
|---|---|---|
| 1 | Ms. Monika Kashyap | P.S. to Director |
| 2 | Mr. Rakesh Kumar Kushwaha | Jr. Accountant |
| 3 | Mr. Ramesh Kumar | Jr. Accountant |
| 4 | Mr. Vinod Kumar | Sr. Library Info. Asst. |
| 5 | Suchetna Shachi | Jr.Assistant |
| 6 | Sushma Kumari | Stenographer |
| 7 | Sunil | Jr.Assistant |
| 8 | Sushil kumar Pal | Jr.Assistant |
| 9 | Kamal Jeet Singh | Jr Lab Assistant |
| 10 | Amit  Sharma | Jr Lab Assistant |
| 11 | Lalit Kumar | Jr Lab Assistant |
| 12 | Ashish Kumar Ahirwal | Sr. Library Info. Asst. |
| 13 | Abhishek Audichya | Staff Nurse |
| 14 | Brijesh Kumar | Pharmacist |
| 15 | Dr. Sumit Kumar Guin | Medical Officer |
| 16 | Dr. S.K.Pathak | Deputy Librarian |
| 17 | Neeraj Chauhan | Junior Engineer (Elect) |
| 18 | Khushi Ram Bhagat | PTI |
| 19 | Dr. Amit Kumar Singh | AR(Store & Purchase) |
| 20 | Ms. Chandan Sharma | Junior Superintendent |
| 21 | Mr Yadvinder | Assistant Engineer |
| 22 | Abhijeet Tiwari | SLIA |

## Deputation Staff as On 31/03/2013

| Sl. No. | Name | Designation |
|---|---|---|
| 1 | Er. Rajan Kapoor | Superintending Engineer |
| 2 | Er. Hemant Kumar Behl | Assistant Engineer (Elect.) |
| 3 | Er. Yashwant Singh Chandel | Assistant Engineer (Civil) |

## Student Leadership -2012

| | |
|---|---|
| Sanchit Khattry | General Secretary |
| Eshaan Agarwal | Cultural Secretary |
| Sachin Roongta | Sports Secretary |
| Jayesh Gupta | Technical Secretary |
| Kshitij Bansal | Literary Secretary |
| Deepak Sharma | Academic Secretary |
| Hemant Jalota | Research Secretary |

## Ph.D. Scholars - 2012 Batch

| | | | |
|---|---|---|---|
| 1 | D12049 | Gourab Dey | SBS (Chem) |
| 2 | D12051 | Richa Pandey | SBS (Chem) |
| 3 | D12052 | Tripti Vats | SBS (Chem) |
| 4 | D12053 | Mohit Chawla | SBS (Chem) |
| 5 | D12054 | Mangili Venkateswarlu | SBS (Chem) |
| 6 | D12055 | Darsi Rambabu | SBS (Chem) |
| 7 | D12056 | K Lingeshwar Reddy | SBS (Chem) |
| 8 | D12057 | Shilpa Sharma | SBS (Chem) |
| 9 | D12064 | Sohan lal | SBS(Physics) |
| 10 | D12065 | Abdus Salam Sarkar | SBS(Physics) |
| 11 | D12066 | Manoj Das | SBS(Physics) |
| 12 | D12067 | Harmanpreet Singh | SBS(Physics) |
| 13 | D12068 | Sandeep Sharma | SBS(Maths) |
| 14 | D12069 | Pankaj Narula | SBS(Maths) |
| 15 | D12070 | Subit Kumar Jain | SBS(Maths) |
| 16 | D12071 | Suraj Shankarlal Meghwani | SBS(Maths) |
| 17 | D12072 | Swati Tyagi | SBS(Maths) |
| 18 | D12074 | Pravindra Kumar | SCEE |
| 19 | D12075 | Pulkit Sharma | SCEE |
| 20 | D12076 | Satyanarayan Patel | SE |
| 21 | D12078 | Maninder Bagga | SE |
| 22 | D12079 | Yashwant Kashyap | SE |

| 23 | D12080 | Amit Kumar | SE |
| 24 | D12081 | Himmat S Kushwaha | SE |
| 25 | D12082 | Saurabh Singh | SE |
| 26 | D12084 | Renu | SBS |
| 27 | D12087 | Neha Sharma | SCEE |
| 28 | D12088 | Vipul Sharma | SBS (Chem) |
| 29 | D12089 | Prateep Singh Sagara | SBS (Chem) |
| 30 | D12090 | Vikas Sharma | SBS (Life Sciences) |
| 31 | D12091 | Gaurav Chetal | SBS(Life Sciences) |

## MS Scholars - 2012 Batch

| 1 | S12021 | Aditya Chauhan | SE | 2012 |
| 2 | S12022 | Ankit Sharma | SE | 2012 |
| 3 | S12023 | Anmol Kothari | SE | 2012 |
| 4 | S12024 | Manoj Dhiman | SE | 2012 |
| 5 | S12026 | Tarun Kumar | SE | 2012 |
| 6 | S12027 | Deepak Kumar Sharma | SCEE | 2012 |

## B.Tech Students - 2012 Batch

| Sl. No. | Enroll | Student Name | Branch |
|---|---|---|---|
| 1 | B12001 | JAYDEEPKUMAR GONDALIYA | CSE |
| 2 | B12002 | SOHIL SAMIR SAVLA | CSE |
| 3 | B12003 | AKANKSHA GUPTA | CSE |
| 4 | B12004 | NEERAJ SHARMA | CSE |
| 5 | B12005 | AMAN GROVER | CSE |
| 6 | B12006 | MOHIT SHARMA | CSE |
| 7 | B12007 | RISHIKESH BARVE | CSE |
| 8 | B12008 | KAUSTUBH PRIYA | CSE |
| 9 | B12009 | MD ANZER MOID | CSE |
| 10 | B12010 | HRUDAYA RANJAN SAHOO | CSE |
| 11 | B12011 | KARRA SAITEJA REDDY | CSE |
| 12 | B12012 | MANI KUMAR | CSE |
| 13 | B12013 | AMAN GARG | CSE |
| 14 | B12014 | NIKHIL GARG | CSE |

| 15 | B12015 | ROHIT PATIYAL | CSE |
|----|--------|---------------|-----|
| 16 | B12016 | SEHAJ DUGGAL | CSE |
| 17 | B12017 | JIBRAAN SINGH CHAHAL | CSE |
| 18 | B12018 | NEHA GUPTA | CSE |
| 19 | B12019 | ADITYA CHAUHAN | CSE |
| 20 | B12020 | SHIVAM SATIJA | CSE |
| 21 | B12021 | PARMAR ANANDKUMAR KISHORBHAI | CSE |
| 22 | B12022 | TEJPAL YADAV | CSE |
| 23 | B12023 | SUBHASH KUMAR | CSE |
| 24 | B12024 | AMBUJ SOM | CSE |
| 25 | B12025 | JYOTI | CSE |
| 26 | B12026 | MILAN GUPTA | CSE |
| 27 | B12027 | AADIL AHMAD ANSARI | CSE |
| 28 | B12028 | ABHAY PRATAP SINGH | CSE |
| 29 | B12029 | A SANJEEVA RAIDU | CSE |
| 30 | B12030 | HIMANSHU KAMBOJ | CSE |
| 31 | B12031 | NANDESHWAR HIMANSHU MAHADEO | CSE |
| 32 | B12032 | SUNIL KUMAR | CSE |
| 33 | B12033 | ANKIT KUMAR GAUTAM | CSE |
| 34 | B12035 | MRSRINATH | CSE |
| 35 | B12036 | PAWAN KUMAR | CSE |
| 36 | B12038 | RAMAVATH SAIKIRAN | CSE |
| 37 | B12039 | AJAY KUMAR | CSE |
| 38 | B12053 | MS ANSHU SHARMA | CSE |
| 39 | B12059 | DEVANG BACHARWAR | CSE |
| 40 | B12066 | GAUTAM VIJ | CSE |
| 41 | B12068 | GAUTAM SURI | CSE |
| 42 | B12069 | SANDESH KUMAR SINGH | CSE |
| 43 | B12101 | MEHTA KUMAR JITESH | CSE |
| 44 | B12114 | VARIGONDA PAVANTEJA | CSE |
| 45 | B12120 | ABHISHEK CHAUDHARY | CSE |
| 46 | B12130 | AMIT YADAV | CSE |
| 47 | B12051 | VIKRAM PALIWAL | EE |
| 48 | B12052 | YOGESH JAIN | EE |
| 49 | B12055 | SARVESH KUMAR GUPTA | EE |
| 50 | B12056 | KARTIK JAIN | EE |
| 51 | B12057 | ZOHAIB MAJEED | EE |
| 52 | B12058 | ANUP MISHRA | EE |
| 53 | B12060 | GUMMULURU PANNAGA SAMEER KAUSHIK | EE |
| 54 | B12061 | VENKATA ROHITH PESALA | EE |
| 55 | B12063 | CHERUKURI SUMANTH | EE |
| 56 | B12064 | AITA AVINASH NATH | EE |

| 57 | B12067 | DIVAKAR MAURYA | EE |
|----|--------|----------------|----|
| 58 | B12070 | SHREYA TANGRI | EE |
| 59 | B12071 | BHUJADE RAHUL SADANAND | EE |
| 60 | B12072 | PRASHANT KUMAR | EE |
| 61 | B12073 | SUBHASH KUMAR | EE |
| 62 | B12074 | SUDHEER KUMAR | EE |
| 63 | B12075 | HIMANSHU RATHORE | EE |
| 64 | B12076 | SHRUTI PAL | EE |
| 65 | B12077 | KADAGALA SWARNALATHA | EE |
| 66 | B12078 | R ROHIT KUMAR | EE |
| 67 | B12079 | MUJAVAR RASUL NABILAL | EE |
| 68 | B12080 | PARAMJIT SINGH | EE |
| 69 | B12081 | NIRAJ KUMAR SINGH | EE |
| 70 | B12082 | SANDEEP KUMAR | EE |
| 71 | B12083 | ANIL KUMAR MATHUR | EE |
| 72 | B12085 | PERAM AKHIL | EE |
| 73 | B12086 | PEETALA SNEHITH RANA | EE |
| 74 | B12087 | ROHIT RAGHAV | EE |
| 75 | B12088 | BHUVNESH MEENA | EE |
| 76 | B12089 | RAHUL KUMAR MEENA | EE |
| 77 | B12090 | KAJAL MEENA | EE |
| 78 | B12037 | REETA MEENA | EE |
| 79 | B12122 | SAKSHAMA GHOSLYA | EE |
| 80 | B12129 | SEELA AISWARYA | EE |
| 81 | B12102 | AMLADI AMOGH GAUTAM | ME |
| 82 | B12103 | RISHABH RANJAN SINGH | ME |
| 83 | B12104 | DESHINGE AKSHAY AJAY | ME |
| 84 | B12105 | KUNAL JOSHI | ME |
| 85 | B12106 | NIKHIL KUMAR KAYATHWAL | ME |
| 86 | B12107 | AARJAV MALHOTRA | ME |
| 87 | B12108 | PRATEEK GAUBA | ME |
| 88 | B12109 | KUMAR VAIBHAV | ME |
| 89 | B12110 | AMAN AGRAWAL | ME |
| 90 | B12111 | MAYANK SINGH RAJPUT | ME |
| 91 | B12112 | DHRUV VASHISTH | ME |
| 92 | B12113 | ANKIT AGARWAL | ME |
| 93 | B12115 | SREEPADA VENKATA RATNA KIRITI | ME |
| 94 | B12117 | UDAY SOOD | ME |
| 95 | B12119 | MOHIT BHATIA | ME |
| 96 | B12121 | KRISHNA WALSE | ME |
| 97 | B12123 | SHISHIR PRIYADARISI | ME |
| 98 | B12124 | RAJAT RAJ | ME |

| 99 | B12125 | DEVENDER KUMAR | ME |
|---|---|---|---|
| 100 | B12126 | ADESH KUMAR | ME |
| 101 | B12127 | MOHD ZAKIR HUSSAIN | ME |
| 102 | B12128 | BOPPANA KARTHIKEYULU | ME |
| 103 | B12131 | ANURAJ G P | ME |
| 104 | B12132 | ABHISHEK BADWAN | ME |
| 105 | B12133 | HEMANT KUMAR | ME |
| 106 | B12135 | AKSHAY KUMAR RAMTEKE | ME |
| 107 | B12136 | PARAMJIT SINGH KAINTH | ME |
| 108 | B12137 | ROHIT KUMAR BHARTI | ME |
| 109 | B12138 | VIPIN RAJ MEENA | ME |
| 110 | B12139 | RAMRAJ MEENA | ME |
| 111 | B12140 | MANISH KUMAR BHUARYA | ME |
| 112 | B12054 | GOURAV PANWAR | ME |
| 113 | B12062 | GARIMELLA HARIKA | ME |
| 114 | B12065 | MONIL CHUGH | ME |
| 115 | B12084 | HIMANSHU RANJAN | ME |

# Media Coverage both Newspapers and TV

## Mandi IIT committed to green technology: Experts

**KULDEEP CHAUHAN**
**TRIBUNE NEWS SERVICE**

MANDI, JULY 28

Experts assert that the IIT, Mandi, is committed to green technology with human face to devise globally recognised solutions for the problems of society and industry by applying computational intelligence to tap green energy that is in sync with the fragile Himalayan eco-system.

Addressing a five-day seminar on "Computational Intelligence Applications to Renewable Energy" organised by the IIT, Mandi, recently, acting director, Prof Lalit Malhotra, Prof Subrata Ray and Prof B Subramanian said the IIT, Mandi, was committed to accomplishing this task.

Research efforts done by the IIT, Mandi, would go a long way in finding a lasting solution to industries in the Himalayan region with glob-

> **Scientists must pool in efforts for the integrated research planning for energy as well as natural resources in India.**
> — Prof Subrata Ray

ally recognised standards. The seminar provided a platform for different groups to solve the challenges of green energy for a sustainable society, they said.

In his inaugural address, Professor Malhotra highlighted the accomplishment and research activities of the IIT, Mandi, and shared his vision to achieve the objective of a "just, inclusive and sustainable society".

"The thrust area is to devise globally recognised solutions for the problems of society and industry, particularly in the fragile eco-system of the Himalayas," he said.

Professor Ray said the scientists must pool in the research

planning for energy as well as natural resources in India.

"The philosophical view of word 'energy' itself acts as catalyst for its wider application," said Dr Subramanian.

The experts said computational intelligence techniques could find a solution to renewable energy problems. Various issues of the electric grid operation, management and control were also discussed.

Dr BS Rajpurohit and Dr Anil Kr Sao, coordinators of the seminar, emphasised that tapping of small hydro energy, wind energy, solar energy remained expensive and needed some cheaper technology suited to the Indian power sector.

Prof Ashwani Chandel

from NIT, Hamirpur, Dr NM Pindoriya from IIT, Gandhi Nagar, VK Agarwal from NLDC, Pawan Kohli from HPPCL, Mandi, Bandanjot Singh from National Instruments and Dr Umakant Divedi from RGIIPT were among the speakers. A field visit to 990MW Dehar Power House at Slapper was also organised.

The seminar was supported by the Council of Scientific and Industrial Research and the Ministry of New and Renewable Energy. It was jointly organised by the IIT, Mandi, and IEEE, Delhi.

The seminar drew more than 35 participants from academic institutions, power utilities and industries from different states, including UP, Punjab, Tamil Nadu, Maharashtra, Delhi, Haryana, Rajasthan, Himachal Pradesh, Andhra Pradesh and Uttarakhand.

## Grid failure poses threat to power projects: Expert

**KULDEEP CHAUHAN/TNS**

MANDI, JULY 31

Frequent trippings and the collapse of the northern grid pose a threat to power projects in the state if the required "frequency band" in the grid system is not maintained, warns an expert.

Talking to The Tribune, Dr Bharat Rajpurohit, assistant professor at the School of Electrical Engineering, IIT, Mandi, said frequent trippings and the collapse of the northern grid, probably due to the imbalance caused by the overdrawal of power from the grid, could harm

power projects if their operations were not stopped during the outage. He said grid discipline had to be observed by all users to save the system from collapsing.

Dr Bharat said "a frequency band of 49.62 on the lower side and 50.2 on the higher side" had to be maintained at the grid.

The failure of the northern grid for the second time today resulted in a blackout in the power-surplus state as commercial transactions were hit in establishments, including banks, from noon till the supply was restored around 5.30 pm.

## Scientists for sun-charged power grid system for Himalayas

Prof TA Gonsalves, Director, IIT Mandi, delivers a lecture at a national workshop at IIT in Mandi on Tuesday.

**KULDEEP CHAUHAN/TNS**

MANDI, JULY 2

Technologists have prepared a road map for building a sun-charged, smarter direct current (DC) power micro grid system that suits the power sector, mainly in the ecologically sensitive Himalayas.

"This system will be secure from terrorist and virus attacks, stable, low cost and reliable for sustainable energy sector in the country," technologists said.

Director, IIT, Mandi, Prof TA Gonsalves and Prof S Mahulikar, who inaugurated a national workshop on "Strategic Research Vision to Build a Smarter Grid" that concluded at IIT, Mandi, stressed the need

to devise globally recognised solutions for the problems of society and industry mainly in the fragile eco-system of the Himalayas. The industry institutions and social groups must join hands to solve the challenges of security, stability and reliability for a sustainable energy sector, Professor Gonsalves added.

In his keynote address, Professor Gonsalves said the economical DC micro-grid could solve the problem of energy deficit and reliability of power grid for the rural sector. "It utilises and converts direct sunlight available free to us and is a part of low-cost technologies development suited for the rural sector," he added.

Professor Mahulikar said the

country needed an integrated research planning for energy as well as natural resources. "It is a vision for building a smarter grid and its suitable applications for efficient power grid operation," he added.

Workshop coordinators Dr BS Rajpurohit and Dr Samar Agnihotri emphasised on developing the technological and regulatory solutions to build a healthier and economical power grid. "This grid will be efficient, free from virus and terrorist attacks and we are already introducing incremental changes in the present system. It will cater to renewable energy sources like small hydro energy, wind energy and solar energy for the power sector," Dr Samar added.
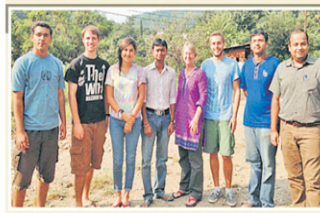
## छात्रों ने तलाशा सोलर लाइट का नया विकल्प

**खोज** मंडी आईआईटी में यूएसए के छात्रों के साथ मिलकर कर रहे है प्रोजेक्ट पर कार्य, 20 घरों में चल रहा प्रयोग

संजय सैणी | मंडी

मंडी आईआईटी ने सोलर लाइट का नया विकल्प लोगों के सामने रखा है। सोलर-डे लाइट प्रोजेक्ट के तहत आईआईटी मंडी की टीम ने यूएसए की टीम के साथ मिलकर सोलर लाइट की नई रिसर्च की है जिसे कमांद, नवलाय व कटींडी गांव में प्रयोग के तौर पर यूज किया जा रहा है। प्लास्टिक बोतल का यूज कर आईआईटी ने लोगों के लिए सोलर लाइट का विकल्प तलाशा है। एक कमरे में बोतल सोलर लाइट लगाकर सीएफएल बल्ब की रोशनी ली जा सकती है। जिस पर कोई खर्चा भी नहीं है। आईआईटी की इस तकनीक से एक परिवार दिन में प्रयोग होने वाली लगभग 30 यूनिट तक बिजली

### सस्ती सुविधा मिलेगी

आईआईटी मंडी के प्रोजेक्ट कोऑर्डिनेटर डॉ. शैल अंजार ने बताया कि सीएफएल बोतल विकल्प को गरीब वर्ग के लोगों को ध्यान में रख कर तैयार किया गया है। आईआईटी अपने सामाजिक दायित्व के तहत लोगों को बेहतर व सस्ती सुविधा उपलब्ध करवाने के लिए कार्य कर रहा है।

बचाई जा सकती है। बोतल का सीएफएल प्रयोग के लिए केवल मात्र एक बेकार बोतल की ही जरूरत होती है। आईआईटी मंडी के छात्रों ने यूएसए के तीन छात्रों के साथ

मिलकर इस रिसर्च को किया है। जिसके लिए यूएसए के छात्र विशेष रूप से मंडी आए हुए है। बोतल को सीएफएल के रूप में प्रयोग करने के लिए केवल मात्र पानी से

के अंदर। अंदर वाला हिस्सा कमरे को अपनी रोशनी से रोशन करेगा। सीएफएल का बोतल विकल्प लाने का आईआईटी का मुख्य उद्देश्य ऐसे घरों को डे-सोलर लाइट से चमकाना है जिनमें दिन में अंधेरा रहता है। सा... ही उस बिजली की खपत को कम करना है जो दिन के समय प्रयोग की जाती है। प्रोजेक्ट को समाज म... परिवर्तन लाने के लिए तैयार कि... गया है। आईआईटी मंडी के डे... भारत ने बताया कि इस तकनीक क... सिद्धांत मोहन, अभिषेक नील... विवेक व यूएसए के मर्टिकन एरि... नोर केशकिन, माटशेक व प्रोफेस... इनग्रिड की टुम्ब ने तैयार किया है... तकनीक का प्रयोग के तौर पर कमांद नवलाय व कटींडी में 20 घरों में प्रयोग किया जा रहा है।

भरा जाना है। पानी में कुछ क्लोरीन डाला जाता है। उसके बाद बोतल को मकान की छत में इस तरह से फिट करना जिससे आदी बोतल छत के बाहर रहेगी व आधी छत

## आकाश टैबलेट के गुण मंडी में हो रहे तैयार

**आईआईटी में प्रयास** छात्रों की पांच टीमें शिक्षा से संबंधित एप्लीकेशंस पर कर रही काम, छात्रों को दिया जा इस बारे में प्रशिक्षण

भास्कर न्यूज | मंडी

मंडी आईआईटी देश की उन प्रमुख आईआईटी में शामिल हो गई है जो आकाश टैबलेट पर काम कर रही है। मंडी आईआईटी में आकाश टैबलेट के एप्लीकेशन पर काम हो रहा है। मंडी के अलावा मुंबई, गुवाहाटी, खड़कपुर, कानपुर और मद्रास आईआईटी में एप्लीकेशंस तैयार हो रहे है।

मंडी आईआईटी में आकाश टैबलेट के एप्लीकेशन तैयार करने में पांच टीमें काम कर रही हैं। यह टीमें टैबलेट के लिए एप्लीकेशनंस डिजाइन करेंगी जिसका कार्य चल रहा है। आईआईटी मंडी द्वारा तैयार किए जाने वाले सभी एप्लीकेशन शिक्षा से संबंधित होंगी।

### 10 छात्रों को मिले है टैबलेट

मंडी आईआईटी में आयोजित विशेष कार्यशाला में जेएनएन इंजीनियरिंग कॉलेज सुंदरनगर के छात्रों के लिए आईआईटी मंडी में आकाश टैबलेट तकनीक पर प्रशिक्षित करने का भी आयोजन किया गया। तकनीक को फॉलो करने के लिए एप्लीकेशन तैयार करने वाले जेएनएन इंजीनियरिंग कॉलेज के 10 छात्रों को पुरस्कार के रूप में टैबलेट भी मिले। टैबलेट इंजीनियरिंग कॉलेज के छात्रों को उनकी परफॉर्मेंस के आधार पर चयन कर दिए गए।

### जेएलएन इंजीनियरिंग कॉलेज के लगाई कार्यशाला
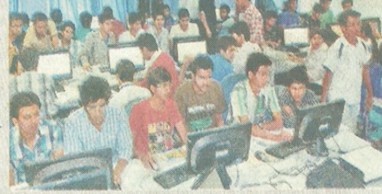
आकाश टैबलेट प्रोजेक्ट की जानकारी सुंदरनगर स्थित जवाहर लाल नेहरू इंजीनियरिंग कॉलेज के छात्रों को मंडी आईआईटी की ओर से दी गई। छात्रों को आकाश टैबलेट के एप्लीकेशंस बनाने के गुर सिखाए गए। छात्रों को आकाश टैबलेट की इंट्रोडक्शन व ट्रेनिंग के बारे में बताया गया। विशेष कार्यशाला में लगभग 65 छात्रों ने हिस्सा लिया।

> मंडी आईआईटी में आकाश टैबलेट के एप्लीकेशंस बनाने पर काम हो रहा है। तकनीक को तलाशने इंजीनियरिंग कॉलेज सुंदरनगर के छात्रों को अवगत करवाने के लिए कार्यशाला आयोजित की गई। छात्रों को आकाश टैबलेट के एप्लीकेशन तैयार करने का प्रशिक्षण दिया गया।
> **डॉ. आरती कश्यप**, प्रोजेक्ट कोऑर्डिनेटर, आकाश टैबलेट, आईआईटी मंडी।

## आईआईटी मंडी स्मार्ट पावर ग्रिड बनाने में जुटा

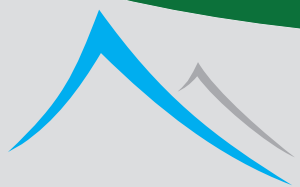**सिर्फ वर्क** प्रयोग सफल रहा तो पावर ग्रिड सिस्टम के फैलियर होने से मिलेगी निजात