

ABOUT NERD

NERD is a student-led initiative on Science Communication, started by IIT Kanpur, aimed at promoting interest in and popularizing Science and Technology through publishings, talks, workshops and competitions.

The major objective of **NERD** is to promote awareness on recent advances in science and technology and to ignite a passion for the development of these fields of knowledge.

HISTORY

The idea of **NERD** has been around for a long while but the actual formulation began in June 2007 and the work started in December 2007, with the first issue of the magazine coming out in June 2008.

We have published more than 15 issues of magazines and newsletters since 2008. As part of our magazine, we have been publishing perspectives of eminent professionals as well as work carried out by aspiring scientists and students.

We have not relied on publishing alone to achieve our objectives, but we have also explored other means. SCoPE Talks (Science Communication and Public Engagement) play an integral part in promoting our mission. **NERD**-sponsored competitions include Scientoon, Science Poetry Writing and Science Fiction Writing, a Takneek (intra IITK sci-tech festival) staple.



Dear Readers,

We feel pleased to inform our supporters about the arrival of our newsletter after a long duration. During this period, we have had a lot of exciting events and now we bring to you the current newsletter citing the recent achievements of research scholars and aspiring students. In this issue we have included stories on ISRO's Mars Mission and GNSS Reflectometry for Earth Observation.

It is our pleasure to welcome our readers and supporters to **NERD** so that you may assist us in our mission by submitting your invaluable feedback as well as ideas. Help us boost the activities of **NERD** on a large scale.

Best regards, Team **NERD**



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IITK Motorsports Season-I

IIIIK Motorsports, the institute's first ever Formula student racing team, was founded in December 2010. A team comprising of 5 members started off with the aim of designing and fabricating a 4 wheeled open cockpit vehicle which complied and with

cockpit vehicle which complied the international standards set up by the ruling committee of FSAE. Eventually the team grew up to have 40

up to have 40 members. The car had its first run in the wee hours of 22^{nd} August. Subsequent testing was carried out at the airstrip. The Director of IIT Kanpur flagged off the car on 28^{th} August.

The team participated in FS, Italy, 2013 held at the Riccardo Paletti Circuit, Varano deMelegari from September 13-16. Finishing with an overall ranking of 33, the team secured an impressive 9th and 13th position respectively in the Cost Report Event and Business Logic Presentation respectively. Apart from gaining technical knowledge, the team members also enhanced their management skills. This marked the end of first season with everyone geared up to build a much better race car the coming season.

Specifications

Powered by a 500CC Royal Enfield engine, "91" has a pushrod actuated double wishbone suspension.

The car has a minimum turning radius of 2.5m and has 4-wheel hydraulic disc brakes with fully floating rotor assembly capable of producing a deceleration of 1.3G.

It has ergonomically designed pedal assembly to facilitate driver comfort and has enough traction forces for a safe ride in wet conditions.

If you would like to know more, contact the Society of Automotive Engineers (SAE) group at sae.iitk@gmail.com

DESIGN. BUILD. RACE.

Shanti Swaroop Bhatnagar Award for Engineering Sciences



Dr. Bikramjit Basu Dept. of Materials Science IIT Kanpur

The Shanti Swaroop Bhatnagar Award in Engineering Sciences for the year 2013 went to Dr. Bikramjit Basu, distinguished Professor of the department of Materials Science and Engineering at IIT Kanpur, and currently Associate Professor at IISc Bangalore, Materials Science Center *"for his outstanding contributions encompassing theory and experiments to significantly expand our understanding of the in vitro cell functionality modulation on engineered biomaterials using electric field simulation approach."* What Dr. Basu did was to apply electricity to grow cells like bone, cardiac and nerve atop an artificial substrate (the engineered biomaterial). Take the example of natural bone which consists of collagen (a protein that gives bone its resilience)and hydroxyapatite (the source of bone calcium-provides strength and rigidity). Dr. Basu heads the Laboratory of Biomaterials here at IIT Kanpur, which he established. He has also recommended a new Centre for Excellence in Biomaterials at IISc. The government's Department of Science and Technology in Delhi is evaluating his proposal. Working with students and collaborators at IIT Kanpur, IISc and Brown University, Dr. Basu currently grows cells on non-living materials to manufacture prototypes of new bones.

For making such a material, the bioengineer in reality requires a precise knowledge of when and how much electric current to apply to cells growing on foreign foundations so that the normal processes of cell-division and life are not affected. In addition the material should facilitate inter-cellular communication. In a unique experiment in his lab Basu showed that when electrical current was sent in, his bone implants allowed cells to "crosstalk" and grow, helping the scientific community gain valuable insight into the modulation of cell function.

Sources : Live Mint-Wall Street Journal - Oct 17, 2013. India Today -September 27, 2013. TEAM **NERD** congratulates Dr. Bikramjit Basu on his achievements and wishes him an even more successful research career.

ABOUT THE SHANTI SWAROOP BHATNAGAR AWARD

S ir Shanti Swaroop Bhatnagar was a well-known Indian Scientist and a professor of chemistry. He was the first director-general of the Council of Scientific and Industrial Research(C-SIR), and he is revered as the "father of research laboratories". To honour his name and achievements, CSIR instituted an award Shanti Swarup Bhatnagar Prize for Science and Technology, since 1958 for outstanding scientists who made significant contributions in various branches of science.

The SS Bhatnagar Awards are widely considered to be the most prestigious awards for science and technology in India. The prize comprises a citation, a plaque, and a cash award of Rs. 5,00,000. In addition recipients also get Rs. 15,000 per month up to the age of 65 years.

Promoting GNSS-Reflectometry in Remote Sensing

GNSS (Global Navigation Satellite System) - the aggregation of satellite constellations for the purpose of navigation is the predominant navigation system available today. It also has immense potential for observations of critical phenomenon occurring in the atmosphere, at the surface and beneath the surface of Earth using concepts of positioning and reflectometry.

Brief Introduction to GNSS

Positioning through GPS the American navigation satellite constellation is based on the principle of time and phase ranging. That is you fire a signal and measure the time it takes to reach the other end.

The range is measured in a time pulse system and in a phase based system. Now adding the other satellite navigation constellations to the earliest GPS system, the GNSS becomes capable of delivering the current market needs in terms of coverage, repeatability and acquisition duration. Measurements are available on different temporal scales, the fastest nearly a second, with a worldwide coverage area as compared to remote sensing satellites.

Why GNSS-R?

Traditionally, remote sensing has been performed with specific dedicated satellites and hence the cost requirements involved were tremendously large. Furthermore the availability of data and coverage are constrained . In this sense especially for developing nations like India, the incorporation of GNSS for remote sensing is a significant and effective alternative as it provides a less expensive means to remote sensing. There are no additional requirements for the transmitter. There are many signal sources available regularly from the various satellite constellations as mentioned previously. Wide range of applications is possible using conventional reflectometry and polarimetry.

In order to increase awareness on GNSS-R organizations such as International Center for Numerical Methods in Engineering, Spain and University of Purdue have been conducting workshops (2010,12 respectively). 'IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing' is publishing the research held in the workshops at University of Purdue, with the next workshop scheduled in 2015. In the upcoming issue of NERD several other applications shall be briefly elaborated.

GNSS Reflectometry:

The Basic principle of reflectometry is the measurement of reflected waves in various aspects from a surface for characterization of the inbound surface. Figure 1 shows an approximate visualisation of corresponding signal waveforms that are retrieved for a single shot.





The specular point is defined as the point for which the retrieved waveform has maximum power (power spectral density). Thus it is possible to determine the roughness of the surface by identifying the amplitude and power spectral density of the returned signal.



Figure 2 : Ground-based GPS altimetry The GNSS-R altimetry model is used predominantly in oceanography for the measurement of sea surface height which leads to further many implicit derivations associated to the study of various phenomenon like magnitude of tides. Figure 2 shows the GNSS-R in effect at lake Walchen and Lake Koechel from GFZ-Potsdam near Munich, Germany.

Sources : Educational tutorial: A brief introduction to remote sensing using GNSS Reflections- Guffini GNSS Reflectometry at GFZ at DLR TUM- Schil Helm

S CoPE talk organised by NERD on 31st October by Prof. Verma demonstrated experiments which although seemed mundane revealed something far deeper. He showed the common experiment of a water-filled glass supporting the weight of a coaster when inverted The audience was quizzed on the exact moment when the pressure inside the glass reduced to support the weight. The second experiment had the audience pondering upon the reason for the increase of water level in an overturned tumbler on a water-filled saucer when a burning

candle inside it extinguishes.

"Two figures (left and right) are the two elementary level physics experiments elaborating the phenomenon behind the lid not coming off and that of the water level rise."



Think you can give better explanations? Write to us, the best shall be included in front of the Science community in our next newsletter. Many prizes in store so keep them coming.



Your comments and contributions are always welcome. Please send them to the Editor at nerd@iitk.ac.in.

MISSION "MANGALYAAN"

A fter the success of 'Chandrayaan', ISRO is all set for its most ambitious mission 'Mangalyaan'! Indian Space Research Organisation (ISRO) is planning to launch the Mars Orbiter Mission (MOM), informally called Mangalyaan by the media. This is India's first interplanetary mission to the planet Mars with an orbiter craft designed to orbit Mars in an elliptical orbit. All eyes are set on this project as it promises to demonstrate ISRO's technological prowess and create a ground for future Mars explorations. If successful, ISRO would become the fourth space agency to reach Mars, after Roscosmos, NASA, and ESA. The estimated total project cost is up to 4.54 billion Rupees. ISRO will be using its indigenously developed Polar Satellite Launch Vehicle for the purpose. ISRO is taking help from NASA to provide communications and navigation support to the mission.

Mangalyaan's on-orbit mission life is expected to be between six and ten months. The spacecraft structure and propulsion hardware configurations for the mission are similar to Chandrayaan 1, India's first successful robotic lunar probe that operated from 2008 to 2009, with specific improvements and upgrades needed for a Mars specific mission.

The objectives of mission are to firstly, showcase the country's rocket launch systems, spacecraft-building and operational capabilities. Secondly, the probe will be carrying a high-tech suite of sensors to explore Martian surface. The main objective of this first Indian mission to Mars is to develop the technologies required for design, planning, management and operations of an interplanetary mission. The secondary scientific objectives are to study the Martian surface features, morphology, mineralogy and the Martian atmosphere. Mangalyaan will be carrying a scientific payload of 15 kg which includes instruments for atmospheric, particle environment and surface imaging studies.

Mangalyan blasted off on 5th November, 2013 at 14:38 hours from Sriharikota. PSLV-C25 (Polar Satellite Launch Vehicle) will first put Mars Orbiter Mission into Earth's orbit. It will enter Mars' orbit on 21 September 2014. Till then let us keep our fingers crossed and all the best to ISRO!

Sources : isro.org Article at ndtv.com, Nov 5, 2013



Department of Physics IIT Kanpur

The book *"The electromagnetism of* the induction motor" is written by IITK UG student Shayak Bhattacharjee and published by LAP Lambert Academic Publishing Company. The book deals with a new approach to dynamic modeling and performance analysis of the induction motor. In this book, the applications of the induction motor have also been considered. A discussion of the steady state and dynamic Control of the motor has also been considered in this context. From a pedagogical point of view, the book includes a brief recapitulation of classical electromagnetism in Chapter 1, and a detailed discussion on solution of electromagnetic boundary value problems in Chapter 4.



Scientoon



Polar ice caps are decreasing at an alarming rate of 9% per decade. At this rate, it is expected that the world will be deprived of all its ice in 2-3 centuries.

Artist: Manish Sharma Electrical Engg. /Roll No: 11404

MESSAGE

NERD has had a lot of interaction with other Institutes and organizations in advancing towards the achievement of its mission. We hereby invite you to be a part of NERD. If you are aspiring as a science professional, NERD is the place to start.

If you desire to create, contribute and communicate - be a part of NERD herd. Simply drop us an e-mail at nerd@iitk.ac.in or call any of our members. Visit us @ http://www.iitk.ac.in/nerd