



YANTRA PATRA

# yantrapatra

NEWSLETTER OF THE  
MECHANICAL ENGINEERING DEPARTMENT

## ISSUE 6



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JSS ACADEMY OF TECHNICAL EDUCATION, NOIDA

# Rendezvous With Alumnus

Pushpendra Singh Dhakrey

2012-2016 Batch

GATE Rank - 139

Currently Working in BARC



1. How do you feel while working in BARC?

It feels awesome to work here in BARC, and I think that I am very lucky to get this opportunity to work with the greatest minds of the country. Actually, it feels quite adventurous. I get to work with radioactive materials, something of which everyone is afraid.

2. How do you feel your job is different from other private/public sector engineering jobs?

The job at BARC requires thorough knowledge of academics, and here we can also pursue our interests related to core engineering. As an employee, I get a chance to pursue higher studies along with the job and this makes it different from other public sector companies.

3. Any past incident/motivation which triggered you to pursue this job?

As every other science stream student I also wanted to go to IITs or NITs, but I couldn't, so I just lost interest in engineering. But, my elder brother convinced me to pursue engineering from JSSATE, NOIDA. Here I came to know about GATE, through which I got this job. So, my elder brother was the motivation which set me on the path to this job.

4. Which one did you prefer was the more beneficial mode of preparation and why, self-studies or coaching?

Whether one goes to coaching or not, self-study is very important. Coaching guided me thoroughly for the exams and also provided daily motivation to keep my zeal up. For self-study, I preferred NPTEL video lectures and followed standard textbooks to give the final shape to my preparation for GATE.

5. How many hours of study helped you to achieve your goal?

I have followed the ideology that, "Don't count your study hours, study till you find it agreeable with the mind". I used to study in college library for about 6-8 hours daily after college.

6. How did you maintain balance between your studies and extra-curricular activities during college days?

I always fixed my study time first so that it does not interfere with my other activities. I played cricket whenever I got time, and also, I used to go for jogging daily.

7. Did you find college resources (library, teachers, and department) helpful?

College library was my favorite place. Our library has all the possible reasons to regularly visit there and to compel you to spend your valuable time in studying. Teachers and department were also very helpful during the preparation and kept me on the track for the exam

8. What challenges do you face while working in BARC?

Working with the nuclear fuel has never been an easy task, so continuous mental alertness is required during the work to ensure everyone's safety and proper functioning of the reactors. Here, we have to work and simultaneously, study further for the greater good. Although it needs some extra effort, but it is enjoyable too to work and study at the same time.

9. What will you suggest to juniors- further study or directly a job after B.Tech?

It totally depends upon individuals' interest, but in my opinion better option is to go for higher studies after graduation. Here in BARC, I can work as well as study for higher degree at the same time.

10. What opportunities do you get in BARC for further studies?

BARC provides its employees M.Tech. degree during training itself. I can also apply for the doctorate degree once post-graduation is done in HBNI (Homi Bhabha National Institute).

11. A piece of advice to your juniors.

I will just say, clear your basic concepts by going through standard textbooks and if needed follow NPTEL video lectures. As per my experience, I want to say that in the field your skill set is going to be your most reliable companion, your degree is just to fulfill the eligibility criteria, it is your knowledge which makes you suitable for the particular job.

# SOLID OIL BEARINGS

For most applications involving rolling element bearings, standard greases or oils will adequately lubricate a bearing's rolling elements and raceways. However, in instances of extreme or especially demanding operating environments, conventional lubricants may not be able to make the grade.

For example, heavily contaminated process areas subjected to frequent wash downs (such as in the food and beverage industries) will severely test bearing greases. Another challenge: accessibility for re-lubrication may be difficult or virtually impossible.

Such scenarios have led to the development of "non-traditional" bearing lubricant technologies, such as Solid Oil. SKF Solid Oil bearings ultimately promote increased bearing service life and increased machinery uptime.

Solid Oil bearings from SKF are lubricated with a polymer material featuring a porous structure (millions of micro-pores), which is saturated with high-quality synthetic lubricating oil. The pores in the polymer material are so small that the oil is retained in the material by surface tension.

The entire bearing cavity is filled with the material, which encapsulates a bearing's cage and rolling elements, and then is cured. In the curing process, a very narrow gap forms around the rolling elements and raceways to enable the bearing's components to rotate. As the bearing rotates in service, the oil moves into the bearing contact points, providing lubrication right from the start. When operation stops, excess oil is re-absorbed, ready to be released again when needed.

Since the polymer material contains two to four times more lubricating oil than standard grease-filled bearings, re-lubrication of the bearing becomes unnecessary, resolving accessibility and maintenance issues and contributing to uninterrupted bearing service.

Notable applications for Solid Oil bearings in the food and beverage industries include packaging and bottling machines, mixers, blenders, conveyors, separators, grinders, freezers, and yeast ovens – and food grade Solid Oil bearing variants have been developed as unprecedented solutions to meet NSF H1 food safety standards. In the metal and material handling industries, typical applications include overhead cranes, chains, crane wheels, support rollers, rope sheaves, and conveyor systems, among others.

Solid Oil bearings represent suitable solutions for critical operating applications where conventional bearing grease or oil traditionally will fall short. As with any technology, however, it is important to note that every application can present its own set of unique challenges. So, with developing technology application of the idea could be explored and could be made more reliable.

## Thermoplastic Composite Welding Technique

AGC AeroComposites, a UK-based supplier of composite structures, assemblies and components for aerospace and defense, has demonstrated that carbon/polyphenylene sulfide, PPS, composite thermoformed components can be reliably welded to form complex assemblies using resistive composite welding elements that contain no metal meshes or inserts. The resulting welded components demonstrated consistent high strength and fatigue properties. Moreover, low-cost equipment and materials can be used and the heating-to-welding temperature takes three minutes, AGC says.

The process is not limited to flat components; panels with significant curvature also can be reliably welded, the company says. When tested, all resulting welds proved to be high quality with no voids, passing standard ultrasonic non-destructive testing (NDT) specifications, the company says.

Welded top-hat sandwich panels were produced and structurally compared by torsional strength and fatigue testing to identical riveted parts. The welded component had higher stiffness and greater strength reaching five times that of the riveted component. Fatigue performance of the welded component was also superior with no damage at 350,000 cycles in comparison to the riveted parts that survived 50,000 cycles, AGC says.

Named “CoFusion,” primary aim was to optimize the efficiency and applicability of an innovative, low-cost thermoplastic composite welding process. The project was funded in part by the National Aerospace Technology Exploitation Programme, or NATEP, in partnership with the UK National Composites Centre, TenCate Advanced Composites and Rolls Royce

## Air Purifier System

Indoor air is, on average, five times as polluted as outdoor air. It can worsen allergies and asthma, and over the long term can cause respiratory diseases and cancer. Yet today’s air purifiers and HVAC systems use decades-old filtration technology, and they often miss microbes, pollen, mold and nasty airborne chemicals that cause these problems.

These situations give rise to the need of new air-purifying technology that would irradiate all problems associated with the today’s technology. In the same context, a concept is proposed by Mr. Yash Goswami, (solar energy researcher who directs the Clean Energy Research Center at the University of South Florida) that would be using a device that blows air over a photoactivatable catalyst, instead of a filter to create highly reactive chemicals that destroy VOCs, pollen and other allergens, and microbes.



In his previous work, Goswami developed a solar-powered water purification technology that used sunlight to activate a catalyst, which oxidized organic chemicals to destroy them. Over almost two decades, Goswami has been working on optimizing air flow, light source, catalyst chemistry in air purifier system. The resulting device, called the Molekule, uses a fan to pull air over a Nano catalyst - a nanometer-scale material with controlled molecular properties that catalyzes a chemical reaction. The device removed all 3.9 million E. coli bacteria that were aerosolized and sprayed into it. The device performs much better than the present technologies but still research is going on the product to make it more efficient and economically viable.

# Upcoming Zealicon Events



## Impulse

*Ever wished of making Rockets? Make one using water as a propellant.*



## Beat The Weight

*An activity to carve one's engineering skills and depth in mechanics.*



## Hoverrush

*Build a hover craft and rule the ground, water and air.*



## Game Of Arrows

*An activity which will make you feel in Paleolithic age, the age of archery.*



## Brain Chase

*Challenges one's mental and physical fitness and make them feel every beat of the time.*



## Odyssey Of The Mind

*An activity to check the creativity for writing and drawing.*

# BLUE EYES TECHNOLOGY

Basic idea behind this technology is to create computational machines that have perceptual and sensory abilities as human beings, like we can understand each other's feelings or one's emotional state by analyzing the facial expressions. If we add these perceptual abilities of human to computers, it would enable computers to work together with human beings as intimate partners. It uses non-obtrusive sensing method, employing most modern video cameras and microphones to identify the user's actions through the use of imparted sensory abilities. The machine can understand what a user wants, where he is looking at, and even realize his physical or emotional states.

Blue eyes technology can prove to be a great asset. It can help to reduce human limitation such as, tiredness, oversight, mental and physical illness. It can verify your identity, feel your presence and interact with you.

Blue, stands for Bluetooth, which enables reliable wireless communication and eyes, because the eye movement enables us to obtain a lot of interesting and important information. Blue eyes use sensing technology to identify a user's action and to extract key information. Information is then analysed to determine the user's physical, emotional, or informational state.

Technologies used for this purpose includes emotion mouse, manual and gaze input cascaded (MAGIC), artificial intelligent speech recognition, simple user interest tracker (SUITOR), the eye movement sensor.

Emotion mouse senses the mood by analyzing pressure, galvanic skin response, temperature and heart beat of the user. Analysing these parameters, six basic emotions as anger, fear, sadness, disgust, joy and surprise can be sensed by the computer. It is designed with sensors to sense the different moods of user. MAGIC pointing is a technique of tracking eye movement of the user and performs the desired operation. Image of pupil of user's eye is tracked using an infrared light source. It uses webcam to quickly determine the glints and pupils of the user under variable and realistic lightening conditions. Suitor notices where the user's eyes focus on the screen and helps by fetching more information at the desktop. It fills a scrolling ticker on the computer screen with information related to user's task.

Artificial Intelligent Speech Recognition scans the input words and matches against internally stored words. User speaks to the computer through microphone. The system consists of two major units: DAU (Data Acquisition Unit) and CSU (Central System Unit).

Data Acquisition Unit is a mobile part. It runs on low power consumption batteries. Its main task is to fetch the physiological data from the sensor and send it to the central system to be processed. To accomplish the task, the device must manage wireless Bluetooth connections, Personal ID cards and PIN codes provide operator's authorization. Communication with the operator is carried out on simple 5-key keyboard, a small LCD display and a beeper. When an exceptional situation is detected, the device uses them to notify the operator. Voice data is transferred using a small headset.

Central system unit hardware is the second peer of the wireless connection. It consists of four components: Connection Manager performs low-level Bluetooth communication, Data Analysis Module performs the analysis of the raw sensor data in order to obtain information about operator's physiological condition, Data Logger Module provides support for storing the monitored data, and Visualization Module- provides user interface for the supervisors.

Blue eyes technology reduces manual work and increases efficiency. However, it is not always 100% accurate.

This technology can find a large number of future applications like in automobile industries, in video games, in power stations, to create "face responsive display" , flight control centres and many more...

# REUSABLE ROCKETS: OPTIMIZING ROCKETRY

When we consider about rockets, the first thing that comes to our mind is a humungous structure with very high cost associated designed for single use. The main cost in a rocket launch event is of fabricating a rocket. The cost of designing a rocket and a jet aircraft is almost same. Only difference that makes a rocketry mission much more expensive than using a jet aircraft is the use of new rocket for every new launch event. What if the cost of fabricating a new rocket each time gets reduced from the expenses involved in a launch event? (an average rocket after fabrication may cost from 60-90 million US \$). What if we can use the same rocket for multiple payload transfers.

**SpaceX** has made this possible with its new **Falcon9** rocket and dragon capsule/payload carrier. Till now five test launches of Falcon9 have been conducted and each time, drastic improvements have been made by the observation made for the reasons of failure of the last landing.

**Falcon9** is a reusable rocket made up of aluminum-lithium alloy and that uses liquid oxygen and rocket grade kerosene oil as fuel. It is a specially designed rocket that is capable of landing on a drone ship in ocean after leaving the payloads in LEO (Lower Earth Orbit) or GTO (Geosynchronous Transfer Orbit).

Actually Falcon9 is a two stage rocket instead of a multistage rocket and contain first stage that acts as a reusable rocket and second stage that comprises dragon shuttle that can carry astronauts as well as payload, also a trunk is available in 2nd stage that can be used as a payload carrier.

It comprises a **Merlin vacuum engine** that holds the two stages together and acts as an engine for the 2nd stage to travel in LEO or GTO and plays an important role in detachment of 1st stage to travel back to Launchpad. Falcon 9 consists of grid wings installed in the main first stage of the rocket body that helps it in controlling the flight to launch pad.

While designing Falcon 9, it has been kept in mind to reduce its weight as much as possible, for that aluminum-lithium alloy is used which is much lighter than pure aluminum. Also, the landing legs of rocket are made up of high grade carbon fibre which reduce weight of the structure to much extent and also have very high strength to bear force as well as temperature.

One of the main attractions in Falcon 9 is the octaweb structure used for engine mounting and the 9 merlin engines used which give the advantage that rocket will work properly and efficiently even when two of its engines get shut down due to some technical failure. These





engines have been used keeping in mind their success in Saturn I and Saturn V rockets of Apollo mission.

If rockets such as Falcon 9 become a common trend in rocketry then that will prove to be a huge cost cutting step and can take rocketry to new heights. This could make possible the dream of mankind to live in outer space and would open the gates of establishing colonies on our neighboring planets.

## *From ancient fossils to future cars*

Researchers at the University of California, Riverside's Bourns College of Engineering have developed an inexpensive, energy-efficient way to create silicon-based anodes for lithium-ion batteries from the fossilized remains of single-celled algae called diatoms. The research could lead to the development of ultra-high capacity lithium-ion batteries for electric vehicles and portable electronics.

Titled "Carbon-Coated, Diatomite-Derived Nanosilicon as a High Rate Capable Li-ion Battery Anode," a paper describing the research was published recently in the journal *Scientific Reports*. The research was led by Mihri Ozkan, professor of electrical engineering, and Cengiz Ozkan, professor of mechanical engineering.

Lithium-ion batteries, the most popular rechargeable batteries in electric vehicles and personal electronics, have several major components including an anode, a cathode, and an electrolyte made of lithium salt dissolved in an organic solvent. Overcoming the performance issues related to graphite for anode material, Silicon, which can store about 10 times more energy, is being developed as an alternative anode material, but its method of production so called carbothermic reduction is expensive and energy-intensive.

To change that, the UCR team turned to a cheap source of silicon -- diatomaceous earth (DE) -- and a more efficient chemical process. DE is an abundant, silicon-rich sedimentary rock that is composed of the fossilized remains of diatoms deposited over millions of years. Using a process called magnesiothermic reduction, the group converted this low-cost source of Silicon Dioxide ( $\text{SiO}_2$ ) to pure silicon nano-particles.

This research is the latest in a series of projects led by Mihri and Cengiz Ozkan to create lithium-ion battery anodes from environmentally friendly materials.

Conventional batteries that power electric vehicles causes anxiety for consumers and negatively impacts the sale of these vehicles, because of their reliability and cost. The belief that diatomaceous earth, which is abundant and inexpensive, could be another sustainable source of silicon for battery anodes.

## Departmental activities

### Team VEGA Racing

Team Vega Racing working under the department of Mechanical Engineering, is dedicated to design and fabricate off road vehicles. The team has recently participated in “Enduro Student India 2017” held from 7th- 10th January 2017 in Coimbatore and performed well in the competition by securing the 4th rank in the Event “Endurance”. The team, with their continuous efforts and hard work has come up with flying colours in the event.

### Team OCTAVIUS

The team is dedicated to design and fabricate eco-friendly vehicles. Recently, the team has participated in “Hybrid Vehicle Challenge 2017” organised by “Imperial Society Of Innovative Engineers” from 16th – 19th February 2017 held at Buddh International Circuit India. The team got “Go Green” prize for having maximum fuel efficiency.

### Industrial Visits

On 22nd February 2017, the department had organised an industrial visit to Gokul Engineering in Sekarandabad, U.P. Gokul Engineering is the lead supplier to the piping unit of NTPC. Around 80 students witnessed the pipe manufacturing process and learned about the various technologies and processes involved in pipe manufacturing.

## List of Important Dates of Competitive Exams

IES/ISS 2017 organised by UPSC	12th May 2017
Engineering Services (Mains) organised by UPSC	14th May 2017
Civil Services (Preliminary) organised by UPSC	18th June 2017
Civil Services Mains 2017 organised by UPSC	28th Oct 2017
CDS II 2017 organised by UPSC	19th Nov 2017
CAT 2017 organised by IIMs	Aug - Sept 2017
AFCAT II 2017 organised by the Indian Air Force	Sept 2017

# TEAM

# यान्त्रपत्रा

HEAD OF MECHANICAL ENGINEERING DEPARTMENT

Dr. Mamatha TG Gangadhar

FACULTY ADVISOR

Dr. Prashanth Chauhan



Pooja Singh  
President



Aprajita Pal Singh  
Management Head



Vivek Chaturvedi  
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Editorial Executive



Anmol Gupta  
Design Executive



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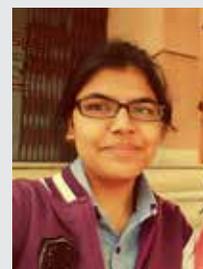
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