



Dear Friends,

Greetings from IIT Bombay!

It pains me to say that the month of April has brought with it this time, not its usual air of joviality and gayety, rather a state of uncertainty among all campus residents. A segment of that endless cycle, when the institute would be alive with the hustle and bustle of students hastily gearing up for the end semester, has now been replaced with a state of desolation. But even in this situation of crisis, the flame that burns in each one of us has yet to be extinguished. I take this opportunity then, to update you of the current situation on the campus as well as to showcase some of the most brilliant pieces of research being conducted in the institute.

On March 19, by executive order, the Collector took over Two floors of Van Vihar Building, Hostel 18, a part of Hostel H8 in the campus and MTNL Guest House (rented by IITB outside the campus) as a designated quarantine for all flyers (C-category, i.e., those without symptoms) coming into the city from various international destinations. Recently, the batch of flyers, who had occupied rooms in Van Vihar Guest house has departed after successfully completing their mandatory duration of quarantine. Other facilities on the campus remained unutilised. As of May 1, only one campus resident, who worked outside the campus as a health-worker, had tested positive for the novel coronavirus. On that day, IITB authorities immediately shifted the family to the Van Vihar guest house, for a quarantine period of 14 days. None in the family members has shown any symptoms. The infected individual has now completely recovered and is back to her normal routine along with her family.

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## Faculty Research at IIT Bombay

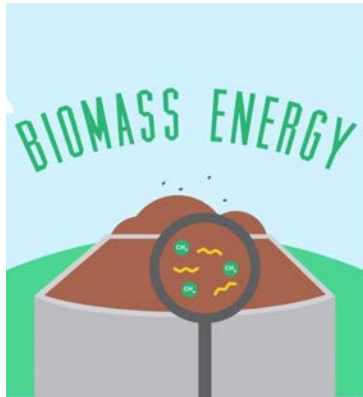
### Monsoon, the Most Complex Meteorological Phenomena and its Regional Projections – A Faculty Research Perspective

It gives us immense pleasure to disport the remarkable and extraordinary research of Prof. Subimal Ghosh from the Department of Civil Engineering, IIT Bombay. Prof. Ghosh has embedded the tiara of his achievements with several diamonds, the brightest of them being the Shanti Swarup Bhatnagar Prize 2019, one of the highest research honours. The accolade was awarded to him as a recognition for his significant contribution to the understanding of how land surface processes influence the Indian monsoon, as well as for improving regional monsoon simulations and predictions.



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# Student Research activities at IIT Bombay

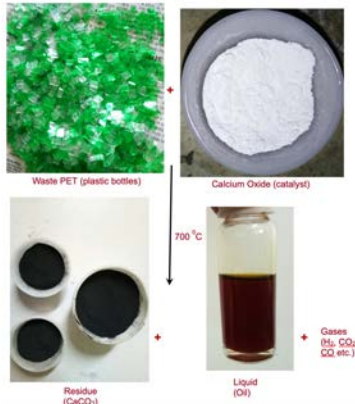


## Experimental & Modeling Study of Downdraft Gasification for High Ash Content Feedstock by Haseen Siddiqui

Biomass can be a potential renewable alternate owing to broad abundance and high energy content. Gasification converts biomass into synthesis gas that can be subsequently used for electricity, fuel and chemical productions. The chemical and physical properties of biomass have huge variations depending on its type and geographical conditions that make the gasification process biomass specific. Such limitations deteriorate the gasification performance and make the process expensive.

The idea of my work is to come up with a user friendly and efficient gasifier that can accommodate a wide range of biomass, irrespective of its physical and chemical properties.

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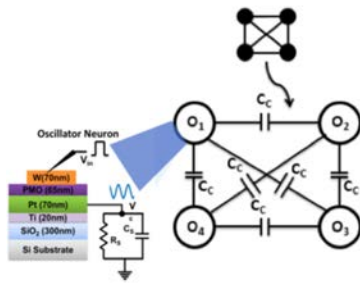


## Research on Plastic Pyrolysis by Manish Mosalpuri

Plastic pyrolysis is a method to convert waste plastics into a range of useful products like hydrocarbon liquids like fuel oil, gases like methane and hydrogen and wax. This helps in not only reducing the plastic waste but also in generating some useful energy products from the process. The focus of the project is on the pyrolysis of waste polyethylene terephthalate (PET), a type of plastic from which all the water and soft drinks bottles and many fabrics are made. The aim of this project is to maximise the yield of benzene in the liquid oil obtained on pyrolysis of PET.

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## PMO based oscillator neuron for neuromorphic computing by Sandip Lashkare

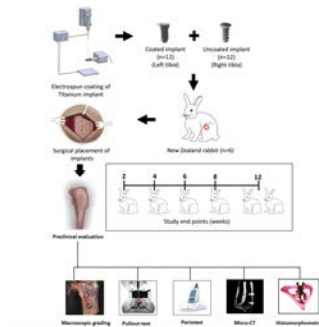


Approaching the end of Moore's law i.e. doubling the number of transistor on a chip in approximately every two years, the researchers of computing and electronics domain turned to new architectural approaches as opposed to Von-Neumann architecture in today's computers to improve the computational efficiency in terms of power, time, and area. Among various architectures explored, the brain-inspired architectures have gained significant attention due to its massively parallel computational power at low energy cost in solving optimization problems like pattern recognition, vertex-coloring, travelling salesman problem.

With such inspiration from brain, oscillatory neural networks or neurocomputers are being developed globally. However, the low power and area scalable nano-oscillator and dense oscillatory network integration is still a challenge.

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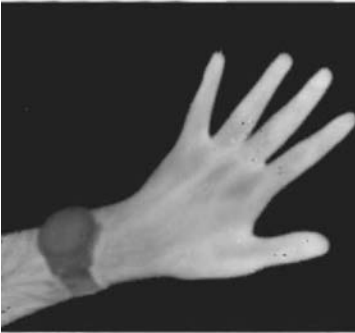
## Nanofibrous coated metallic implants by Siddhartha Das



The contemporary use of implants for orthopaedic and dental applications has witness gradual evolution with significant advances coming from the specialty of dental implantology. The real expectation of endosseous implant was to accomplish their task through mechanical anchorage with bone i.e. osseointegration as described by Branemark et al. in 1952. Various surface treatment modalities like machined, sandblasted, acid etched, anodized, plasma-sprayed, etc. have been explored as the possible means for improving the bio-response of titanium (Ti) implants in bone.

In our attempt, polycaprolactone (PCL) with gelatine in conjunction with osteoinductive (dexamethasone, ascorbic acid, and  $\beta$ -glycerophosphate) and osteoconductive (hydroxyapatite) chemicals were incorporated in the optimized osteogenic nanofibrous coating, fabricated on the endosseous portion of the titanium implants via modification of the electrospinning apparatus.

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## Investigation of various capping layer configuration on heterogeneously coupled SML on SK quantum dots heterostructure by Pravin Raut

Numerous civilian and military applications, including night vision, missile tracking, and environmental monitoring, require high-sensitivity and low-noise infrared sensors. Quantum-dot infrared photodetectors (QDIPs) are positioned to become an essential technology in the field of infrared (IR) detection. My work mainly focuses on the InAs/GaAs quantum dots(QDs) devices, primarily investigating the influence of the dot's capping layer on the carrier confinement.

We have introduced a theoretical analysis of the hybrid heterostructure consisting of submonolayer (SML) stacks grown above the SK(Stranski-Krastanov) QDs with various capping layer combinations. By simulating the hydrostatic and biaxial strain in the multiple samples, we came up with the best device structure that can give better carrier confinement. Thus the device can be operated at a higher temperature compared to conventional HgCdTe detectors leading to higher efficiency.

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