PDEU

PANDIT DEENDAYAL ENERGY UNIVERSITY

SOT

SCHOOL OF TECHNOLOGY

The Newsletter of Department of Chemistry

CHEMSTREET

June (Issue No. 2)

Celebrating Environment Day

June 05, 2021

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FROM EDITORS' DESK

Warm greetings to the readers of the Newsletter!!

*We are pleased to share with you the second issue of the newsletter "**CHEMSTREET**". In this edition, we are celebrating "World Environment Day". Environment plays a vital role in keeping living things healthy. The environment acts as a blanket that supports life on the planet safe and sound. It provides food, shelter, air and fulfills all human needs. Likewise, it maintains the ecological balance on earth. We cannot imagine life on this planet without an environment.*

Calamities like wildfires, cyclones and floods, locust attacks across Africa and India and the coronavirus pandemic is a reminder that human health is linked to the planet's health. Thus, people must understand that they have a role to play in preserving nature for our future.

Let's rethink our relationship with the living world, ecosystem and biodiversity.

We would also like to take this opportunity to thank the contributors of the newsletter for their constant support in making this e-newsletter a success.

Editorial Team

MESSAGE FROM PATRONS

Dear Colleagues and Students,

Humans have been for too long exploiting and destroying our planet's environment in the name of development. Every three seconds, the world loses enough forest to cover a football pitch and over the last century we have destroyed half of our wetlands. As much as 50 per cent of our coral reefs have already been lost. Therefore, Ecosystem restoration - preventing, halting and reversing this damage – to go from exploiting nature to healing it is the need of the hour. Only with healthy ecosystems can we enhance people's livelihoods, counteract climate change and stop the collapse of biodiversity.

As Tata Group's Chairman Emeritus Mr. Ratan Tata expressed on this World environment day that we as responsible citizens need to pledge, to build a better environment for India, so that there is "Fresh air to breathe, clean water to drink and nutritious food with no one left hungry, and a way to care for everyone's health".

We @PDEU strongly believe that Sustainable Development is a core value for us and through technology we hope to perform actions that meet the need of the present generation but do not compromise on the ability of the future generations to fulfil their own needs. The limitless power of technology that enables us to achieve development sustainably and the conviction of my faculty colleagues and students that the golden age is ahead of us - and not behind us – brings about the best in all of us which is reflected in their achievements.

*I am happy to introduce the next issue of the Newsletter "**CHEMSTREET**" which not only shares with all its readers the latest news and developments in the Department of Chemistry but would also be sensitizing all of us on the environment and sustainability.*

Compliments to the editorial team for their passion for perfection and unbound creativity which makes me always look forward to the next edition of the Newsletter.

Prof. Sunil Khanna, Director, School of Technology, PDEU

Dear Colleagues and Students,

*I feel very happy to introduce the second edition of the Chemistry Department Newsletter "**CHEMSTREET**", which is eventually celebrating Environment Day. Gaining scientific knowledge is not enough unless we implement it for the benefit of our society and environment. The recent pandemic has seen global topsy-turvy; however, one must appreciate how the environment and the ecosystem, which have been disturbed due to human intervention, is trying to come back clean and green due the lockdown and decreasing pollution.*

Chemistry is an integral part of STEM, and responsibility of a chemist is significant as it deals with hazardous materials. We, as chemists, should take pledge to keep our environment clean and green. Chemistry department of PDEU believes in sustainable development clubbed with cutting edge research. Our effort for local and societal development is the key to future success.

My sincere wishes to the editorial team to take forward the Newsletter with a mission to keep the environment as it should be!

Prof. Rajib Bandyopadhyay, Head, Department of Chemistry, SOT, PDEU

MXene: The Next Graphene but Not Graphene

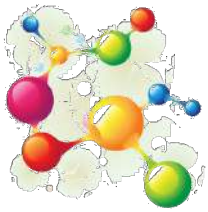
Dr. Nitin Chaudhari

If we knew what it was we were doing, it would not be called research, would it?

- Albert Einstein

Energy and environmental issues have reached crisis levels over the last decade due to the rapid depletion of fossil fuels and climate changes. To address these challenges, the development of electrochemical storage devices such as batteries, supercapacitors, and water electrolyzers for converting hydrogen to electrical energy, as well as fuel cells for efficient conversion of chemical energy in hydrogen to electricity, is critical. To replace high cost and scarce precious noble metals, efficient electrocatalysts comprised of non-precious materials are essential for the development of electrochemical energy storage and conversion devices. After the exfoliation of graphene from graphite in 2004, the research progress on 2D nanomaterials has witnessed great interest in the fields of materials science due to their extraordinary electrochemical properties. Following the beginning of graphene and graphene oxide, numerous two-dimensional (2D) materials based on transition metal (TM) dichalcogenides, metal-organic frameworks (MOFs), metal coordination polymers, and other systems have received considerable attention as electrode materials owing to their unmatched portfolio of optical, electrical, and mechanical properties. Among the 2D materials, transition metal carbides/nitrides (MXenes), the newest additions to the family of 2D materials, have been prepared by the selective extraction of element 'A' from layered hexagonal MAX precursors using hydrogen fluoride as an etching agent, or from layered ceramics. Instead of just one layer, as in graphene, MXenes are a few atoms thick and readily accommodate metallic ions. Furthermore, the large surface area, tunable interlayer distance, and narrow diffusion barrier, combined with the superior metallic conductivity of MXenes, make them potential materials in several fields.

However, their robust tendency to self-restack due to hydrogen bonding or van der Waals interactions is one of the major obstacles, which leads to a substantial decrease in the surface area, inaccessibility of ions and electrolyte, and eventually daunting electrochemical performance. Therefore, for further enhancement of the electrochemical performance, spacers have been introduced between the layers of MXenes to develop a porous structure to considerably increase the interlayer distance to yield better performance. On the other hand, constructing the hybrid nanostructure by combining 2D MXenes and transition metals can preserve the best features of both the MXenes and transition metals, and thereby restacking of the layers is hindered and increasing the contact area between the electrolyte and electrodes. Recent years have seen great efforts to explore several MXene



based hybrid nanostructures, but there is still a long way to go to considerably utilizes MXenes' potential.

At PDEU, our group is extensively working to design and develop hybrid nanostructured materials based on MXene for diverse fields such as electrochemical energy storage and conversion, sensors, waste water treatment, photocatalytic and biomedical applications.

Dr. Nitin Chaudhari joined the Department of Science, School of Technology, PDEU as Associate professor in Feb. 2020. He received his Ph.D. degree in Material Science from Korea University, South Korea in 2013 under the prestigious Korean government's Fellowship. After Ph.D., he worked as research professor at Myongji University and then at Korea University, South Korea between 2013 and 2019. Prior to joining PDPU, he was a Deputy Director at Nexcoms Ltd. Co., Daejeon, South Korea and played crucial role in developing fuel cell technology for Unmanned Aerial Vehicle (UAV). He has over 33 peer-reviewed publications in reputed international journals. He also delivered several platform and invited talks at national and international seminars and conferences. Dr. Chaudhari is also acting as a reviewer to the papers submitted to various journals. His group is currently working on the bilateral international project funded by DST (India) and NRF (South Korea). Dr. Chaudhari is looking for bright, enthusiasts and highly motivated students, pot-doc and researchers to work on the broad area of material science.

Assessing the Contemporaneous Clean Water Crises in India and the Subsequent Scenario

Dr. Prakash Chandra

Fresh water reserves compose of only less than 3% of Earth's surface, whereas the rest of the water reserves are mostly unconventional resources like seawater, sewage water, and salty water. With the increasing human population, scientific communities are seeking for advanced technologies for waste water treatment and purification. World Economic Forum's annual risks report gives a clear indication that the clean water crisis can be regarded as the top five risks for humanity. According to the United Nations (UN) report, more than two billion of the human population is currently witnessing acute clean water crises. India is one of the fastest economies in the world with rapid urbanization having more than 40 million populations living in the urban areas. This rampant urbanization has led to immense pressure on the urban water infrastructure. The average per capita waste water generated by the class-I and class-II cities represents more than 70% of the urban population generating several megaliters per day of waste water with the most liberated to oceans untreated. In India, more than 600 million populations have poor access to clean water with more than 163 million people living in day zero scenarios having no access to clean drinking water. As a result, more than 200,000 people lose their life due to the lack of clean water resources. Additionally, the COVID-19 crisis accelerated the water crisis due to an increase in demand for domestic water consumption by 25-30% because of hygiene awareness. The current developments give a glimmer of hope; with demand for fresh water will increase by 50% by 2030. India is primarily an agricultural country, where the majority of the population relies on agriculture for livelihood. With this scenario, the agriculture industry will be worst affected, followed by other industries that are heavily dependent on clean water like textile, chemicals, paper, food processing, beverages, and leather tanning industries. This will lead to a catastrophe on Indian economic growth. Experts predict that there will be a loss of 6% of GDP. This shortage of clean water will lead to rural-urban gender-based inequalities because in rural India, the expense of getting water is almost equivalent to 150 million women days in each year, resulting in an economic loss of Rs 10 billion in the rural areas of the country. India is the second most populous country in the world supporting 18% of the world population, but has only 4% of fresh water reserves. Most of the fresh water requirements come from underground water and India is the highest consumer of underground water in the world. India urban centres generate domestic sewage waste accounting for 62000 million litres per day. Out of this copious amount of waste water generated, only 23000 million litres per day is treated, that is, 37% of the waste water is treated on the daily basis. Therefore, advanced technique

for the treatment is the need of the hour. According to the Central Pollution Control Board (CPCB) estimation, the urban waste generation will increase to 120000 million litres per day by 2051 leading to more burden on the municipal corporations in India. However, if India uses 80% of the urban waste water generated from the 110 most populous cities, it can fulfil 75% of the industrial water requirements.

To counter these challenges, the Government of India (GOI) launched Swachh Bharat Mission 2.0 (SBM 2.0) to shift the focus towards sludge, sewage, and waste water greywater management. The GOI is launching countrywide awareness programs amongst the public. The Ministry of Housing and Urban Affairs (MoHUA) has set three important criteria for the cities to achieve Water+ status:

1. Treatment of 100% of the industrial, domestic and commercial waste water.

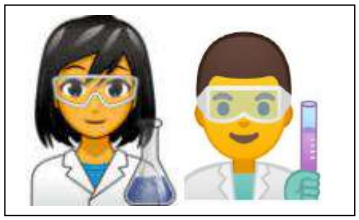
2. Development of adequate techniques for the treatment of waste water and sewage water.

3. Proper maintenance of the infrastructure and the cost-effective techniques for the reuse and recycle of the waste materials must be ensured.

Dr. Prakash Chandra is with PDEU, SOT, Gandhinagar since December 2019. Prior to joining PDEU, he worked as Research Associate at PPISR Bengaluru, IIT Indore and UCL IMCN Belgium. He has more than 3 years of research experience in the field of homogeneous and heterogeneous catalysis for selective organic transformation. Previously, he did his Ph.D. under the guidance of Dr. Shubhangi Umbarkar on the synthesis and application of molybdenum based homogeneous and heterogeneous catalysts for oxidation of organic compounds. He also has experience in the field of application of heterogeneous catalysts for the waste water treatment.

Chemical Entrepreneurship Opportunities

Ranjit Mohili, Junior Research Fellow (JRF)



Federation of Indian Chambers of Commerce & Industry (FICCI) in its 2021-report said that Indian chemical industry is expected to register a growth of 8-9% in the next decade and is expected to double its share in global chemical industry to 5-6% by 2021. Indian Chemical industry has the potential to grow significantly provided some of the key growth imperatives are taken care of. Ambitious chemistry graduates with knowledge in manufacturing and processing can think of starting a small scale start-up in chemical manufacturing and material recycling sector.

IS BUSINESS IN SYNTHETIC SECTOR PROFITABLE?

Synthetic business opportunities are highly profitable and can help India become a global force in export. In terms of production volume, the Indian chemical industry is the 3rd largest producer in Asia and the 6th largest in the world. Government provide incentives & facilitate loans to those who meet environment norms. The Policies have been initiated to set up integrated petroleum, chemicals and petrochemicals investment regions (PCPIRs). In the chemical sector, 100% foreign direct investment (FDI) is permissible. Manufacturing of most of the chemical products is de-licensed. The entrepreneurs need to submit only Industrial Entrepreneur Memorandum(IEM) with the Secretariat for Industrial Assistance, Department of Promotion for Industry and Internal Trade (DPIIT), provided no compulsory licensing from State Government is required.

Around 6-7% of India's GDP(Gross Domestic Production) is contributed by Chemical Industry. Playing crucial role in our daily life, whether it is thermoplastic furniture we use, or a synthetic garment we wear, or a medicine we consume – we all are inevitably associated to it.

You will find different pros and cons also in the following aspects of the Indian Chemical Industry. Such as;

- Never ending demands of India's increasing population.
- Fragmentation between Partners affects large scale operation and growth
- Less attention given to export due to less understanding of international market
- Lagging behind in cost-effectiveness as compared to foreign chemical companies due to a higher cost of electricity, infrastructure and transport, import duties, although abundant resources.
- Insufficient investment in R&D despite innovative synthetic processes
- Lack of skilled labors and professionals
- Very less attention towards advanced safety measures

- Lack of connectivity with consumer

This industry has key linkages with several other downstream industries, such as Automotive, Consumer durable, Textile, Engineering, and Food processing. Here we accumulate highly profitable chemical business ideas for your ready reference. One can develop all these chemical business ideas as small scale basis with moderate capital investment.

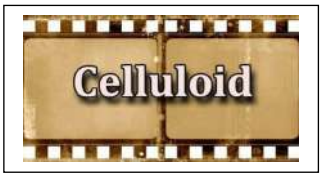
ACID BLEACHING POWDER PRODUCTION

Different types of acids have several applications in the industries. Hence, there always a great demand for different types of acids, and also can be exported at cheaper rate with large scale production.

CAUSTIC SODA PRODUCTION

The NaCl electrolysis process produces 2.25 tonnes of 50% caustic soda with each tonne of chlorine. Salt electrolysis also produces Cl_2 gas.

CELLULOID PRODUCTION



One can produce celluloid from the mixture of different types of chemicals such as nitrocellulose, camphor, alcohol, as well as colorants and fillers depending on the desired product.

CERAMIC GLAZED TILES PRODUCTION

Basically, ceramic glazed tiles resist staining from dirt, grime, and water. Zirconium-based yellow, blue, green and pink stains are used directly for producing colored ceramic glazed tiles.

CHEMICAL ETCHING ON WOOD

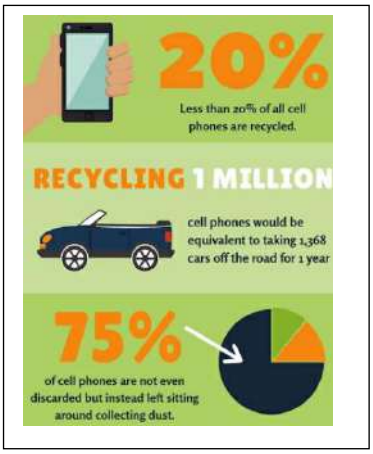
Chemical etching is a process involving artistic imagination to use the natural grain patterns on wood/waste wood to advantage. Nowadays, this is very popular for the doors, windows and even for table surfaces.

CHEMICAL DYE PRODUCTION

Various industries including textile, soap, detergent, beauty, and healthcare industries are the major consumers of chemical dye.

DETERGENT POWDER, DISH WASH BAR/ LIQUID MANUFACTURING

Washing powder is an important ingredient for cleaning and washing purpose. Basically, the small-scale manufacturing process involves mixing and packing operations.



E-WASTE RECYCLING

E-waste includes a wide list of materials such as computers, office electronic equipment, entertainment device electronics, mobile phones, television sets, air conditioner, and refrigerators, which can be recycled in industries.

FACE WASH & TONER PRODUCTION

Nowadays, there are specific face washes and toners are available in the market for both men and women.

FERTILIZER, PESTICIDE & INSECTICIDE MANUFACTURING

Basically, organic fertilizer manufacturing is a growing large scale business which requires a regular supply of raw material.

FIRE EXTINGUISHERS PRODUCTION

Demand for the fire extinguisher manufacturing industry increased over the past five years, as the construction of new private, public, commercial and residential structures.

HERBAL SOAP MAKING

The demand for different types of herbal soaps is also increasing very fast due to the rising awareness of the harmful chemical present in the soaps.

LEATHER POLISH & SHINER PRODUCTION

Leather polish and shiner have a large market worldwide.

LUBRICANT PRODUCTION

As per the Department of Energy, more than 70% of electricity consumed in the industry comes from electric motors. In the motor, the bearing life depends on proper lubrication.

MATCHSTICK AND AGARBATTI MAKING

Basically, people burn Agarbatti for the religious purpose and has become an essential item in every household, temples and at several functions. However, this industry has a major safety concern and need to checks the local laws before commencing the unit.

MICRONUTRIENT MANUFACTURING

Micronutrients are the major important agricultural inputs. Some of the most popular items are Zinc, Boron, Iron, Copper, etc. One can start a micronutrient manufacturing business for both soil use and foliar spray. It is a highly profitable chemical-related business.

NAPHTHALENE BALLS & AIR FRESHENER PRODUCTION

These products come as spray type, gel-type or even as a liquid. Naphthalene balls can be produced from naphthalene flakes by a tablet making machine. Basically, this type of machine has ball shape die. With merely a little technical knowledge, any individual can initiate the business as the home-based also.

NYLON RUBBER GLOVES MANUFACTURING

Nylon production demands specific skills and knowledge about the production process and raw materials. However, the business is highly profitable for the new chemical entrepreneurs.

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Ranjit D. Mohili (born 12 March 1998 in Mumbai, India) received his Master's Degree in Chemistry in 2021, at University of Mumbai and currently working as Junior Research Fellow (JRF) under Dr. Nitin Chaudhari at Department of Chemistry, School of Technology in Pandit Deendayal Energy University, Gandhinagar. Ranjit's research interest is design and development of energy storage and conversion materials, practical demonstration of ideas and teaching chemistry. His hobbies are playing football, cricket, and tennis, cooking and travelling to new places.

The Rights Of Nature

Jeny D Gosai and Nikunj D Vagadiya

What does it mean for nature to have rights? Is it possible for nature to gain rights like humans? Why does nature need rights? Let's tackle one question at a time.

"*Our minuscule brain cannot see what is the might and sophistication of nature. Yet without me needing to understand everything the world exists. The land is not real estate, you own real estate. Then there is land, nature, and nobody owns it."* said Kirsti Luke, Chief Executive, Tuhoe Te Uru Taumatua.

Since the dawn of the Industrial Revolution, humans have viewed nature as a resource from which to extract commodities, fish, energy, minerals, timber, nature is also seen as a place to dispose of waste, often without considering the impacts it may have on the human condition, whose lives depend on a healthy ecosystem. Today, these environmental challenges continue, but a new idea, pulled from ancient indigenous practice may provide the Earth with a rights-based solution.

https://www.oryxphoto.com/tour-item/ecuador-waorani-tribe-amazon-photo-expedition/

Ecuador, a land across the globe known for its untouched ecosystems. Ecuador, and across much of South America, the idea of Mother Earth, termed as Pachamama, as it is known in indigenous Andean cultures as a presence in everyday life. There is no distinction between human and non-human nature. People there believe this not as a metaphor but reality.

In 2008, the constitution assembly of Ecuador came to a new approach, the political view of nature, not just as a resource but as a living entity capable of being legally represented. They decided to recognize the rights of nature, which articulates the view of different indigenous. For decades Ecuador has struggled to protect natural areas: mining, oil drilling even tourism is endangering some of the most biologically diverse places on the planet. This is a country that in the past 10 years has lived through intense environmental conflicts over land. Because once mining, oil, or industrial agricultural projects get underway tension arises with people who traditionally inhabited these regions. Ecuador's Yasuni biosphere reserve in the Amazon basin sits on a multibillion-dollar oil deposit it also happens to be home to Waorani indigenous people numbering less than 3000 with some clans living in isolated existence. You know the whole

https://www.theworldhour.com/maori-tribe/

rights of nature indigenous right interface is right, particularly relevant in a place like Ecuador where indigenous people are living fairly traditional lives in a way that's pretty similar to 1000 years ago.

Their absolute demand is that their resources being held intact. if not, they disappear. So, human rights, and the rights of nature, really are one unit.

https://www.manawahoney.co.nz/story-kaupapa/

Here was an opportunity to give nature, the same rights held by individuals. So, from then on nature is no longer seen simply as an object to be appropriated, to be used, to be exploited, but begin to be seen as a subject having rights. Ecuador had already recognized nature's role in good living, known as Sumak Kawsay or "Buen vivir" but going as far as giving it legal standing was still a stretch for some.

"*Many lawyers considered that these rights could not be given. They said nature cannot be a subject of rights because nature cannot protect itself. It cannot write a document to be presented in court. But people were persuaded when nature was compared with children's rights and how a newborn has all the rights of children even though he cannot go to court and submit a written document. Why? Because it is necessary to have a guardian of these rights. And for nature, the agreement was that the guardian, the representative of the rights of nature, could be any citizen of the country.* ", said Edgar Isch Lopez (professor, Universidad Central del Ecuador).

https://www.britannica.com/place/Himalayas

Ecuador became the first country to establish the rights of nature at a national level. Nature legally could no longer be seen just as a set of natural resources to be exploited. In 2009, the nearby South American nation of Bolivia, also referenced Pachamama, in its constitution, acknowledging that nature had the right to protect and defend itself. These two reforms in Bolivia, and Ecuador would soon have impacts elsewhere this is the vision.

To be honest the rights of nature have been one of the greatest contributions that Ecuador has given to the world. We are a part of nature. And just like humans need bread and money to live, human beings need a relationship with nature also.

Many countries followed this moment including New Zealand, India, and America. The first people to settle New Zealand were Polynesian explorers, the ancestors of the Maori. The 1840s brought European exploration and missionary work to the Wanganui, and by the late 19th century, large river steamers carried passengers and freight from the coast to settlements, upstream. The river was advertised as the ride of New Zealand, attracting 1000s of tourists to the one good. Today, the river and its lands are used for farming, forestry, and tourism. But decades and poor logging and agricultural practices have taken a toll on the Wanganui and its watershed, a well-known fact to both Maori and those of non-Maori descent. To save the river Maori people were trying to take ownership

of the river but the crown denied it. Later the crown apologized for all the wrongdoings and Whanganui was given rights and the representators were two people, one from Maori and one from the government.

https://www.aljazeera.com/news/2017/3/16/new-zealand-river-is-the-worlds-first-legal-person

A similar story was shared by another tribe, the Tuhoe tribe. A 2127 square kilometer region of ancient Moss-covered forests, that is home to 7000 Tuhoe. This mountainous region historically was their homeland. The Tuhoe people are known as *na tamariki o te kohu*, who are the children of the mist. The name that marks them as inseparable from the land. However, in the 19th century, the New Zealand crown or government, aiming to control fertile Tuhoe territories, push them off the land in a deadly scorched earth campaign. Those tuhoe that survived were relegated to a landlord territory with no access to traditional fishing grounds, and they descended into extreme poverty. Later on, in 2004, it was declared that the land will own itself, the Tuhoe rejoiced as now they can go back to their real home.

Himalayan glaciers, rivers, streams, lakes, air, meadows, and forests now have the same legal rights as people after the Uttarakhand High Court in India granted these natural treasures this new status as a way to protect them from pollution and environmental destruction.

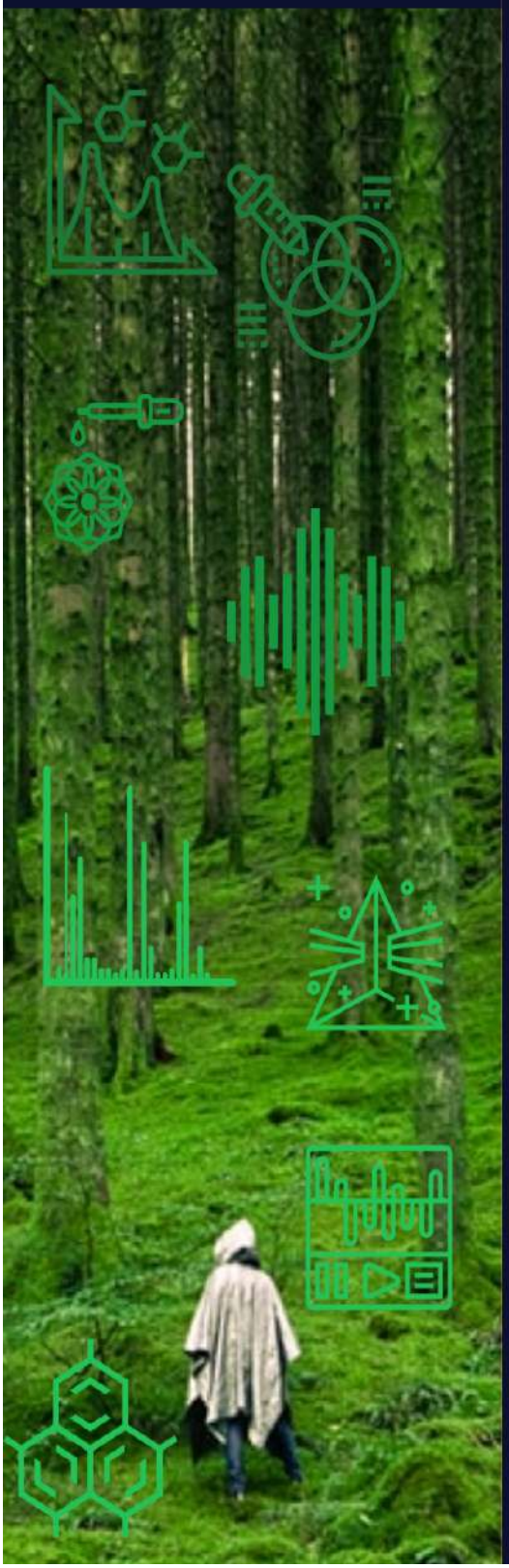
This ground-breaking ruling came ten days after the same court ruled India's sacred Ganges and Yamuna rivers were also legal persons.

In Utah, USA, farmers gave away their water rights to save the great salt lake from going dry. Many beautiful moments like these are seen all over the world and many more to be followed. Even though times are tough, let's take an oath to always protect and preserve our mother earth. It is our parent, and no child hurts their parent.

Nikunj D. Vagadiya (Born 26th, Feb. 2000 in Gujarat, India) received his bachelor's degree in Chemistry from Gujarat University. Currently, pursuing master's degree in Chemistry from SoT, PDEU, Gandhinagar. Previously, Nikunj has been part of R&D and QC Department of Zeni biotech, Ankleshwar as an Intern and presently working on project "Synthesis, Characterization and DFT studies of anthracene based Chemo sensors for Amino acid Sensing." His areas of interest lies in different approaches of organic synthesis and computational studies.

Jeny D Gosai (born on 15th November 1999) received a bachelor's degree in Chemistry from Kadi Sarva Vishwavidhyalaya, Gandhinagar, Gujarat in 2020. At present pursuing master's degree in Chemistry from SoT, PDEU. Her area of interest are nanomaterials, solid-state chemistry, metallurgy, etc. Her hobbies are drawing, clay modelling, reading novels, playing badminton, swimming also she recently joined taekwondo.

MOLECULE & ITS ENVIRONMENT



Hey I am a molecule,
Are you curious to know?
How important is the environment?
Not just humans but we too rely on it.
Since the inception to the exceptions.
It's the environment
that controls all the reaction
Talk about the bonding
my neighbor will decide
how two of us will be holding
whether It will be ionic or
will it form a covalent bonding?
The pull on my neighborhood is so strong
It makes some bonds short and
While some remain long.
The signal in the spectrum
They move up and down
As it all depends upon
the neighbouring atom
the upfield and the downfield shift
the UV-Vis spectra and its chemical shift
change in force constant
the band shift in the IR
it's the environment
that plays the function.
Yes, I am sensitive
Just like you,
You touch me and
My spectrum changes too.
The reactivity and the bond cleavage
my ecosystem decides the reaction.
It all about the environment
I am just a fraction.
All that happens around me
Is just a reaction to my action.

DR. RAMA GAUR

Dr. Rama Gaur,

Assistant Professor, School of Technology since December 2019. She received her Ph.D. degree in Chemistry from IIT Roorkee in 2017. She completed M.Sc. in Chemistry from Dayalbagh Educational Institute, Agra, India in 2012 and qualified for CSIR National Eligibility Test (CSIR-NET-JRF/SRF, AIR 038). Before joining PDPU, Dr. Rama has worked as research assistant at CSIR lab at Indian Institute of Petroleum, Dehradun. She has also served faculty positions at Lovely Professional University, NIT Hamirpur, IIIT Una and SRM University, Haryana.

Other than academics she is actively involved in sports and literary activities.

DEPARTMENTAL EVENTS & ACTIVITIES

Workshops/Webinars Organized

- Informational Webinar on "Electrochemical Methods: Techniques to Applications" was organized by **Dr. Syed Shahabuddin** and **Dr. Rama Gaur** on April 5, 2021.
- Webinar on "Waste to Best: Sustainable Environmental Remediation Strategies and Solutions" organized by **Dr. Syed Shahabuddin** and **Dr. Rama Gaur** (Moderator: **Dr. Nandini Mukherjee,** Technical Committee members: **Dr. Anu Manhas** and **Dr. Megha Balha**) on April 12-13, 2021.
- Webinar on "Science & Innovation: PDEU Ways" jointly organized by Department of Physics and Chemistry and Mathematics (Coordinator: **Dr. Rama Gaur**) on April 25, 2021.
- Webinar on "Climate Change Vital Signs of Planet" jointly organized by Department of Physics and Chemistry and Mathematics (Coordinator: **Dr. Rama Gaur**) on May 8, 2021.
- Webinar on "Material Science & Engineering – Current trends & future prospects" jointly organized by Department of Physics and Chemistry (Coordinators: **Dr. Rama Gaur** and **Dr. Syed Shahabuddin**) on May 8, 2021.
- Webinar on "Amazing Earth: Space to Surface" organized jointly by Department of Chemistry, Physics and Mathematics (Coordinator: **Dr. Rama Gaur**) on May 22, 2021.
- Webinar on "Emerging facets of material science" jointly organized by Department of Physics and Chemistry (Coordinator: **Dr. Rama Gaur**) on May 29, 2021.
- Webinar on "Current and Emerging Career Opportunities in Chemistry" was organized by **Dr. Manoj Kumar, Dr. Megha Balha** and **Dr. Anu Manhas** on June 5, 2021.

RESEARCH PUBLICATIONS

Dr. Anirban Das

- Mandal, R., **Das, A.**, Sudheer, A.K. et al. Sources, controls, and probabilistic health risk assessment of fluoride contamination in groundwater from a semi-arid region in Gujarat, Western India: An isotope–hydrogeochemical perspective. *Environ Geochem Health* (2021). https://doi.org/10.1007/s10653-021-00894-2.

Dr. Kalisadhan Mukherjee

- S. Bera, D. Sengupta, S. Roy, **K. Mukherjee*** Research on dye sensitized solar cell: A review highlighting the progress in India, *J. Phys Energy* (https://doi.org/10.1088/2515-7655/abff6c).

- D. Sengupta, **K. Mukherjee***, Performance analysis of several ZnO based dye sensitized solar cells with identical photo-electrodes, electrolyte and sensitizer, *IEEE Journal of Photovoltaics* (2021) (doi:10.1109/JPHOTOV.2021.3071999).

Dr. Manoj Pandey

- Maitrayee U. Trivedi, Grzegorz Greczynski, Chandra Kanth P., **Manoj Kumar Pandey**, Ivan G. Ivanov, M. Syväjärvi, G. Reza Yazdi, Study of Cucurbit[7]uril nanocoating on epitaxial graphene to design a versatile sensing platform, *Applied Surface Science* 2021, 563, 150096.

Dr. Prakash Chandra

- Shaikh M. Mobin, **Prakash Chandra***, Neha Choudhary, Goutam K. Lahiri, Debabrata Maiti "Copper mediated chemo-and stereoselective cyanation reactions" *Asian J. Org. Chem. 2021.* https://doi.org/10.1002/ajoc.202100182.

Dr. Ranjan Pati

- Chaliyawala, H.A., Narasimman, R., **Pati, R.K.,** Mukhopadhyay, I., Ray, A. Effect of copper pretreatment on optical and electrical properties of camphor-based graphene by chemical vapour deposition. *J Mater Sci: Mater Electron* (2021). https://doi.org/10.1007/s10854-021-06300-y.

Dr. Syed Shahabuddin

- Kalidasan, B., Pandey, A. K., **Shahabuddin, S.**, George, M., Sharma, K., Samykano, M., ... & Saidur, R. (2021). Synthesis and characterization of conducting Polyaniline@ cobalt-Paraffin wax nanocomposite as nano-phase change material: Enhanced thermophysical properties. *Renewable Energy*, 173, 1057-1069.
- Masri, Abdulkader, Sumayah Abdelnasir, Ayaz Anwar, Javed Iqbal, Arshid Numan, Priyanka Jagadish, **Syed Shahabuddin**, and Mohammad Khalid. "Antimicrobial properties of multifunctional polypyrrole-cobalt oxide-silver nanocomposite against pathogenic bacteria and parasite." *Applied microbiology and biotechnology* 105, no. 8 (2021): 3315-3325.

Dr. Tapan Pal

- Sourav Bej, Sukdeb Mandal, Amita Mondal, **Tapan K. Pal**, and Priyabrata Banerjee, Solvothermal Synthesis of High-Performance d10-MOFs with Hydrogel Membranes @ “Turn-On” Monitoring of Formaldehyde in Solution and Vapor Phase, *ACS Applied Materials & Interfaces* 2021, 13, 21, 25153–25163.
- Dhrubajyoti Majumdar, SwapanDey, Annu Kumari, **Tapan K. Pal**, Kalipada Bankura, Dipankar Mishra,Dicyanamide-intertwined assembly of two new Zn complexes based on N2O4-type pro-ligand: Synthesis, crystal networks, spectroscopic insights, and selective nitroaromatic turn-off fluorescence sensing, Spectrochimica Acta Part A: *Molecular and Biomolecular Spectroscopy*, 2021, 254, 119612.

- Dhrubajyoti Majumdar, **Tapan K. Pal**, Shahenur Alam Sakib, Sourav Das, Kalipada Bankura, Dipankar Mishra, Synthesis, spectroscopic characterization, and SC-XRD study of one privileged heteronuclear Ni(II)/Hg(II)-Salen complex: An exclusive DFT outlook , *Inorganic Chemistry Communications*, 2021, 128, 108609.

BOOK CHAPTERS

Dr. Prakash Chandra's following book chapters have been accepted for publication

- Applications of 3d-transition metals as Pt-free counter electrode for dye-sensitized solar cells application in the book "Dye-Sensitized Solar Cells", Elsevier, 2021.
- Fabrication Techniques and Working Principle for the Neoteric Dye Sensitised Solar Cells in the book "Dye-Sensitized Solar Cells", Elsevier, 2021.

Dr. Tapan K Pal published the following book chapters

- Metal Organic Frameworks as Ratiometric Sensors: Application and Outlook, Sourav Das and **Tapan K Pal**, Nova Science Publishers USA, 2021, 1-39.
- Conversion of carbon dioxide to valuable compounds, Dashrathbhai B Kanzariya and **Tapan K Pal**, Micro and Nano Technologies, 2021, 307-352. Publishers: Elsevier.

CONFERENCE PROCEEDINGS

Dr. Syed Shahabuddin has published the following conference proceedings:

- Fitriya, A. M., **Shahabuddin, S.**, Sridewi, N., Norsyarizad, M., & Pandey, A. K. (2021, March). A Brief Review on Conducting Polymer Nanocomposite Based Epoxy Coatings for Marine Applications. In IOP Conference Series: Materials Science and Engineering (Vol. 1127, No. 1, p. 012013). IOP Publishing.
- George, M., Pandey, A. K., Abd Rahim, N., **Shahabuddin, S.**, Tyagi, V. V., & Saidur, R. (2021, March). Investigation on Thermal Properties of AL2O3 Based Phase Change Material Composite for Solar Thermal System Application. In IOP Conference Series: Materials Science and Engineering (Vol. 1127, No. 1, p. 012010). IOP Publishing.
- Thachnatharen, N., **Shahabuddin, S.**, & Sridewi, N. (2021, March). The Waste Management of Polyethylene Terephthalate (PET) Plastic Waste: A Review. In IOP Conference Series: Materials Science and Engineering (Vol. 1127, No. 1, p. 012002). IOP Publishing.
- **Shahabuddin, S.**, Shah, S. N. A., Sabri, M. F. M., & Pandey, A. K. (2021, March). Influence of SDBS Surfactant on Stability, Thermal Conductivity and Viscosity of h-BN/EG Based Nanofluids. In IOP Conference Series: Materials Science and Engineering (Vol. 1127, No. 1, p. 012014). IOP Publishing.

EXPERT TALK DELIVERED/ORAL PRESENTATION IN CONFERENCE-WEBINAR-SYMPOSIUM

Dr. Busupalli Balanagulu

- Presented a paper on 'Asymmetric membrane scission in polymer vesicles induced via osmotic pressure difference', at the virtual 5th Network conference, Network of Researchers on the Chemical Evolution of Life (NoRCEL), March 29-31, 2021, England.

Dr. Kalisadhan Mukherjee

- Speaker for the webinar "Materials Science and Engineering: Current Trends and Future Prospects" organized by PDEU, May 8, 2021.

Dr. Rama Gaur

- Presented a talk in the webinar on "Science & Innovation: PDEU Ways" on 25th April 2021 organized by Department of Physics and Chemistry and Mathematics.

Dr. Syed Shahabuddin

- Delivered a lecture on "Electrochemical Applications in Energy Storage: Supercapacitors" in the Informational Webinar on "Electrochemical Methods: Techniques to Applications" (5th April 2021) organized by PDEU.
- Gave an Expert talk on "Conducting polymers: Wonder materials for adsorption and photocatalysis for treating waste water and used lubricant oil" in the Two Days International Webinar on "Waste to Best: Sustainable Environmental Remediation Strategies & Solution" (12th April to 13th April 2021).
- Gave an Invited talk on "Conducting Polymers Based Nanocomposites: Innovative Materials For Waste Water Treatment and Energy Storage" in the International Online Conference on Nano Materials (ICN 2021) 09th - 11th April 2021 Kottayam, Kerala, India, organized by Mahatma Gandhi University, P.D Hills P.O, Kottayam, Kerala, India & Wroclaw University of Technology, Wroclaw, Poland & Gdansk University of Technology, Poland & Wuhan University, China.

INDUSTRY/ACADEMIA COLLABORATION

Dr. Syed Shahabuddin

Working in collaboration with:

- Universiti Teknologi MARA, Negri Sembilan, Negeri Sembilan, Kuala Pilah Campus, Malaysia.
- The National Defence University of Malaysia

- University of Jiroft, Iran
- University of Malaya, Malaysia
- Fudan University, China

OUTREACH PROGRAM CONDUCTED/PARTICIPATED

Dr. Nitin Chaudhari participated in "Guidelines for Writing Winning Proposals" conducted by Navjivan Centre For Development (NCD) on May 21, 2021.

PARTICIPATION IN FDP

Dr. Nandini Mukherjee participated in the Webinar on "Reaction Monitoring: Reaction Monitoring NMR User's Meeting" organized by Magitrek GmbH on April 28, 2021.

Dr. Rama Gaur participated in the Webinar on "Interface physics and processes behind highly stable and efficient 2D/3D perovskite solar cells" organized by Pandit Deendayal Energy University May 24, 2021.

Dr. Rama Gaur participated in the Webinar on "Current and Emerging Career Opportunities in Chemistry" organized by Pandit Deendayal Energy University, on June 05, 2021.

Dr. Rama Gaur participated in the Webinar on "Synergistic Technologies for Energy and Environment Conservation" organized by Pandit Deendayal Energy University, on June 13, 2021.

HONOURS/AWARDS/RECOGNITION

Dr. Busupalli Balangulu received Certificate of Recognition from American Chemical Society.

Dr. Prakash Chandra awarded Life Membership for Catalysis Society of India.

Prof. Rajib Bandyopadhyay chaired a session at ICRC-CCSU conference organized by PDEU and Supported by Shastri Indo Canadian Institute and scheduled for March 12-13, 2021.

CONSULTANCY

Dr. Manoj Pandey is acting as a Scheduled I Environmental Auditor from Gujarat Pollution Control Board, Gandhinagar.

Prof. Rajib Bandyopadhyay is acting as a Scheduled I Environmental Auditor from Gujarat Pollution Control Board, Gandhinagar.

DEPARTMENTAL ACTIVITIES

Dr. Rama Gaur and Dr. Syed Shahabuddin organized an Informational Webinar on "**Electrochemical Methods: Techniques to Applications"** on April 05, 2021.

Dr. Syed Shahabuddin and Dr. Rama Gaur organized a 2 day International Webinar on **"Waste to Best: Sustainable Environmental Remediation Strategies & Solution**" on April 12-13, 2021.

Department of Physics, Chemistry and Mathematics organized a webinar on **"Science & Innovation PDEU Ways"** on 25th April 2021

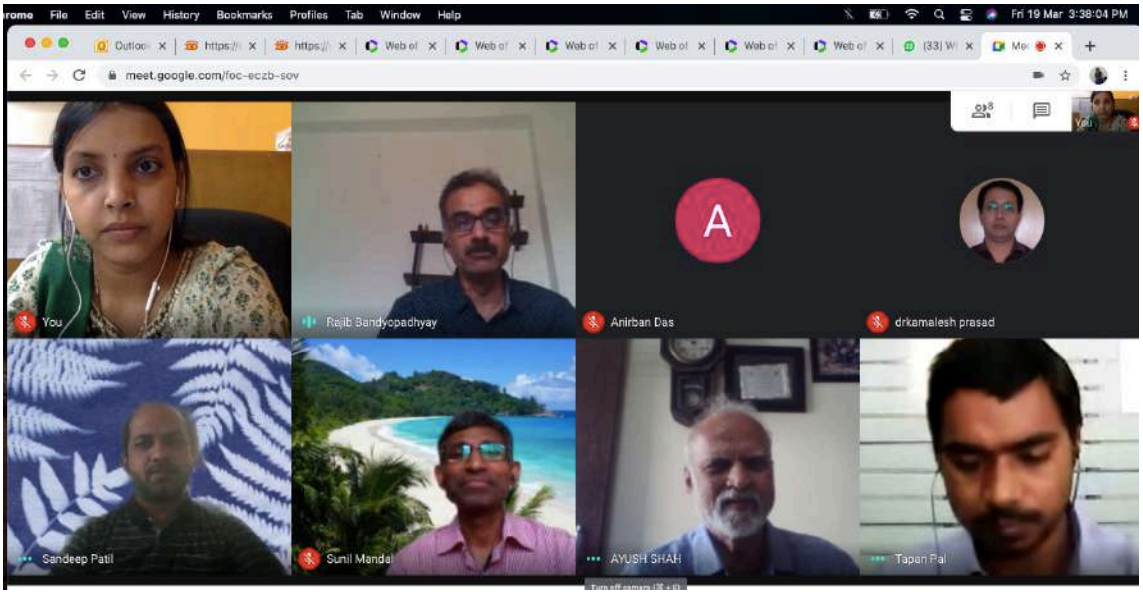
Department of Physics, Chemistry and Mathematics organized a webinar on **"Climate Change Vital Signs of Planet"** on 8th May 2021

Department of Physics and Chemistry jointly organized Webinar on **"Material Science & Engineering – Current trends & future prospects"** on 8th May 2021

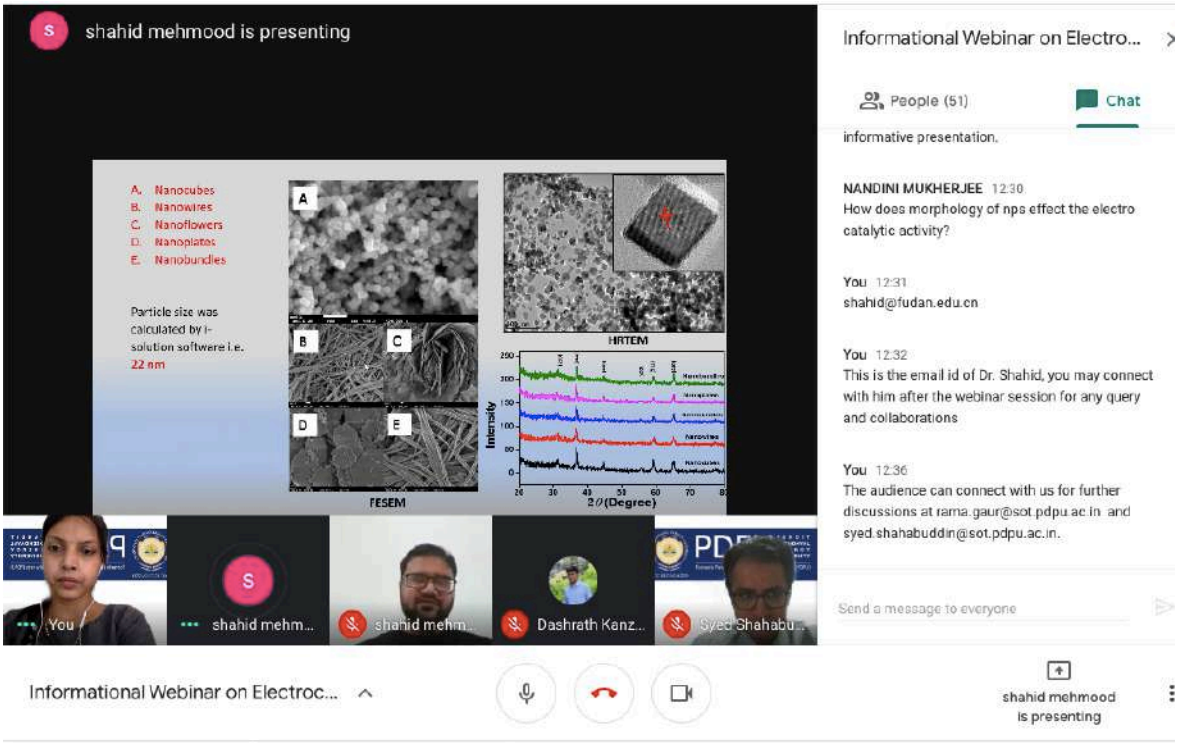
Department of Physics and Chemistry jointly organized Webinar on **"Emerging Facets of Materials Science"** on 29th May 2021

Department of Chemistry, Physics and Mathematics jointly organized a webinar on **"Amazing Earth: Space to Surface**" on May 22 2021

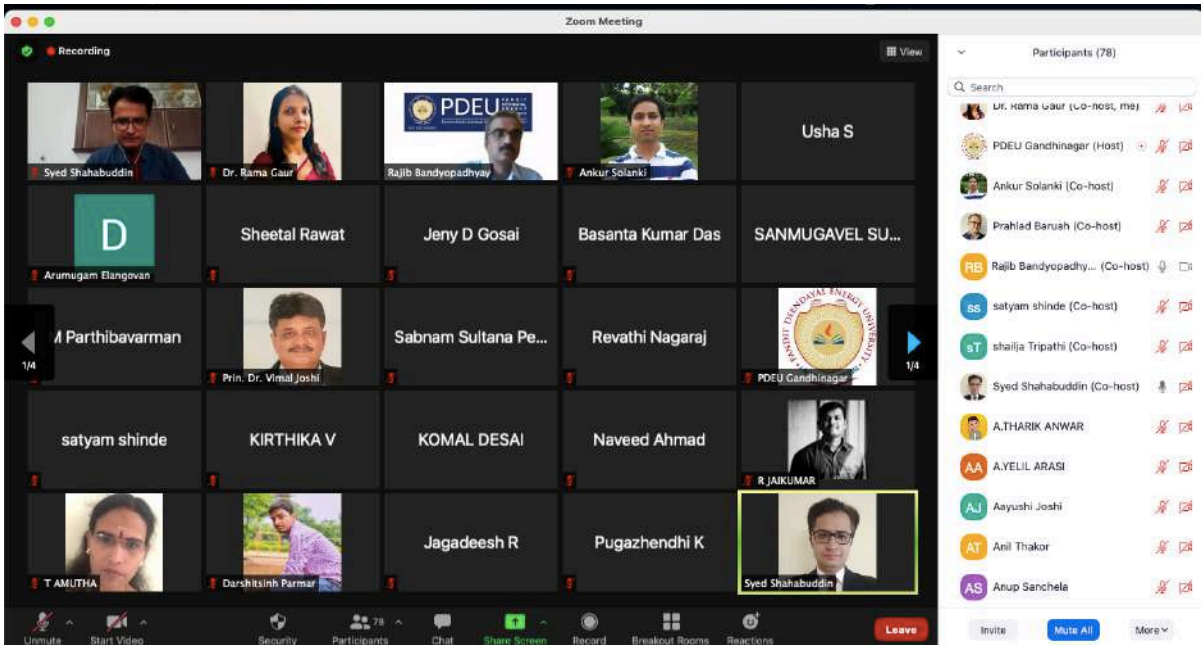
Dr. Manoj Pandey, Dr. Megha Balha and Dr. Anu Manhas organized a webinar on **"Current and Emerging Career Opportunities in Chemistry"** on 5th June 2021



BoS meeting held on March 19, 2021.



Webinar on "Electrochemical Methods: Techniques to Applications" on April 05, 2021.



Webinar on “Emerging Facets of Materials Science” on 29th May 2021

STUDENTS' CORNER

STUDENTS' ACHIEVEMENTS

1. Nikunj Kumar Vagadiya from M.Sc. Sem. 2 has done an Industrial Internship program at R & D and Quality Control department of Zeni Biotech, Ankleshwar on "Synthesis of Salts of Amino acid by different approaches along with QC Analytical lab".
2. Nikunj Kumar Vagadiya from M.Sc. Sem. 2 has completed 8th Computational Chemistry Workshop-2021 under AIMs (Anubhav Inspiring Masterminds) Institute, Delhi, India.
3. Rushik Radadiya from M.Sc. Sem. 2 participated in the webinar on "Climate change: vital signs of the planet" organized by the Departments of Physics, Chemistry & Mathematics, School of Technology, Pandit Deendayal Energy University.
4. Mohil Odedara from M.Sc. Sem. 2 participated in the dialogue on "Indian Diplomacy-Challenges and Opportunities of Engagement with United States and China" with Ambassador Vishnu Prakash.
5. Jeny D Gosai from M.Sc. Sem. 2 participated in the webinar on "Material Science & Engineering – Current Trends & Future Prospects" organized by School of Technology, Pandit Deendayal Energy University.
6. Jeny D Gosai from M.Sc. Sem. 2 participated in the webinar on "Current and emerging career opportunities in chemistry" organized by the Department of Chemistry, School of Technology, Pandit Deendayal Energy University

ZENI BIOTECH

CERTIFICATE OF INTERNSHIP

TO WHOM IT MAY CONCERN

Date : 31 June 2020

This is to certify that **Mr. Vagadiya Nikunjkumar** S/O- **Mr. Dipakbhai Vagadiya**, a student of **B.Sc. (Bachelor in Science) - Chemistry**, Gujarat University, Ahmedabad Has successfully completed **03** (Three) **Months** (from 1st april 2020 - 31 June 2020) long internship programme at this **Research & development and Quality control** department of Zeni biotech.

During the period of his internship Nikunjkumar has worked on Different approaches towards synthesis of calcium and magnesium **(Ca, Mg)** amino acids salt as part of R&D, along with that Nikunjkumar has worked on **Quality control** of calcium and magnesium salt of amino acids while performing exceptional ability to perform his knowledge to the real world scenarios in the Quality control analytical lab.

We appreciate his efforts towards the Research and development of calcium and magnesium (Ca, Mg) amino acids salt. The detailed presentation and final report submission of the findings, are satisfactorily defends his dissertation as an intern and hence we are pleased to confirm the compilation of his summer internship.

We found his efforts sincere, meticulous, enthusiast and result oriented. We wish all the best in his future endeavors.

Sincerely,

HR Manager
Zeni biotech
(Mr. Govind Radadiya)

CEO
Zeni biotech
(Mr.Mansukh Radadiya)

PDPU PANDIT DEENDAYAL PETROLEUM UNIVERSITY

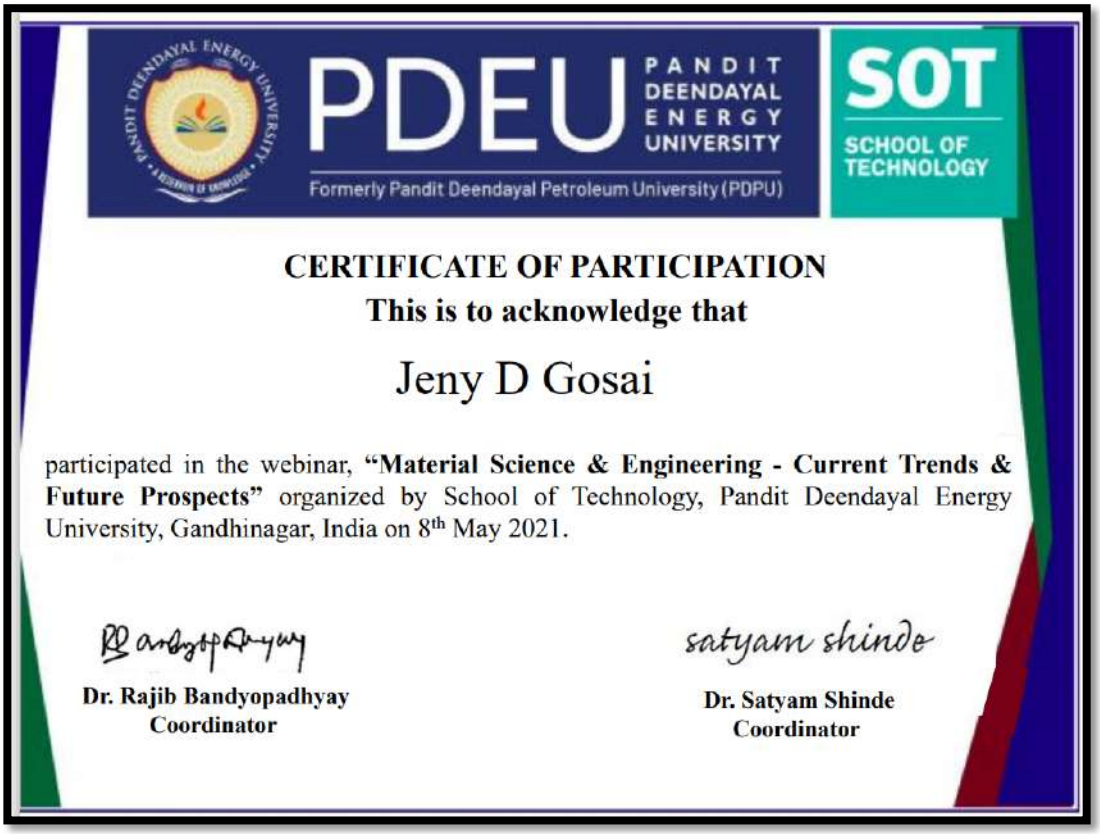
CERTIFICATE OF APPRECIATION

Mohil odedara

This is to appreciate your efforts and participation in the dialogue on "Indian Diplomacy-Challenges and Opportunities of Engagement with United States and China" with Ambassador Vishnu Prakash on 29th November 2020.

Ambassador Vishnu Prakash, (Speaker)

Dr. Milan Bhatt, (NSS Coordinator)



PDEU PANDIT DEENDAYAL ENERGY UNIVERSITY
Formerly Pandit Deendayal Petroleum University (PDPU)

SOT SCHOOL OF TECHNOLOGY

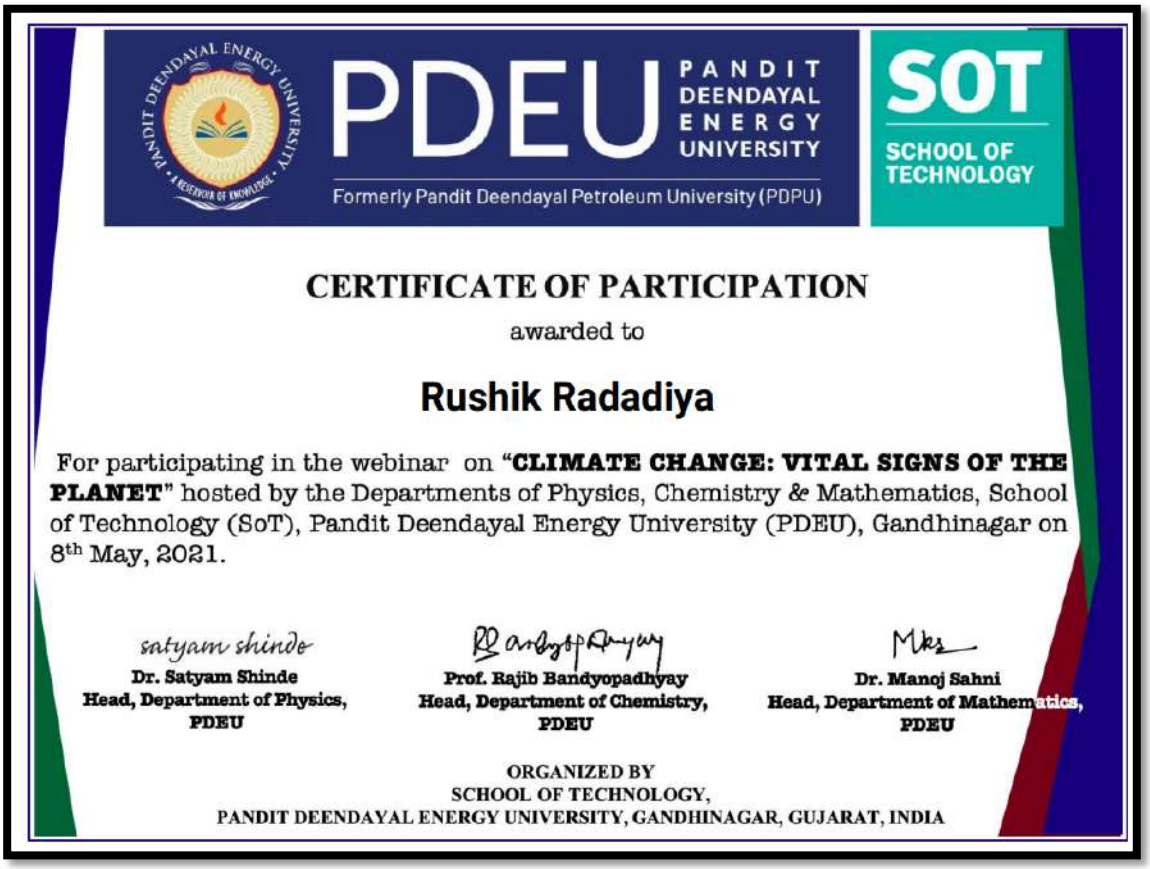
CERTIFICATE OF PARTICIPATION
This is to acknowledge that

Jeny D Gosai

participated in the webinar, **"Material Science & Engineering - Current Trends & Future Prospects"** organized by School of Technology, Pandit Deendayal Energy University, Gandhinagar, India on 8th May 2021.

Dr. Rajib Bandyopadhyay
Coordinator

Dr. Satyam Shinde
Coordinator



PDEU PANDIT DEENDAYAL ENERGY UNIVERSITY
Formerly Pandit Deendayal Petroleum University (PDPU)
SOT SCHOOL OF TECHNOLOGY

CERTIFICATE OF PARTICIPATION

awarded to

Rushik Radadiya

For participating in the webinar on "CLIMATE CHANGE: VITAL SIGNS OF THE PLANET" hosted by the Departments of Physics, Chemistry & Mathematics, School of Technology (SoT), Pandit Deendayal Energy University (PDEU), Gandhinagar on 8th May, 2021.

satyam shinde
Dr. Satyam Shinde
Head, Department of Physics, PDEU

Prof. Rajib Bandyopadhyay
Head, Department of Chemistry, PDEU

Dr. Manoj Sahni
Head, Department of Mathematics, PDEU

ORGANIZED BY
SCHOOL OF TECHNOLOGY,
PANDIT DEENDAYAL ENERGY UNIVERSITY, GANDHINAGAR, GUJARAT, INDIA

8TH CCW
COMPUTATIONAL CHEMISTRY WORKSHOP - 2021
AIMs (Anubhav Inspiring Masterminds) Institute, Delhi, India, https://aimsdelhi.com/services
DATE: 24TH MAY – 28TH MAY 2021, TIME: 11:30 A.M. – 1:00 P.M. (IST)

Certificate of Participation

This is to certify that VAGADIYA NIKUNJKUMAR DIPAKBHAI, MS STUDENT, PANDIT DINDAYAL ENERGY UNIVERSITY, GUJARAT, INDIA has actively participated in the 8th Computational Chemistry Workshop - 2021 (CCW-2021) organized by the Dr. Nikhil Aggarwal, AIMs Institute, Delhi under a **Professional Training Program** category, held from 24TH MAY 2021 – 28TH MAY 2021 (Five Days) via Online Mode.

Dr. Nikhil Aggarwal
Convener
Director (AIMs Institute), Delhi

PHOTOGRAPHY CORNER

"Lights, Nature, Action"

By Jay Parsana

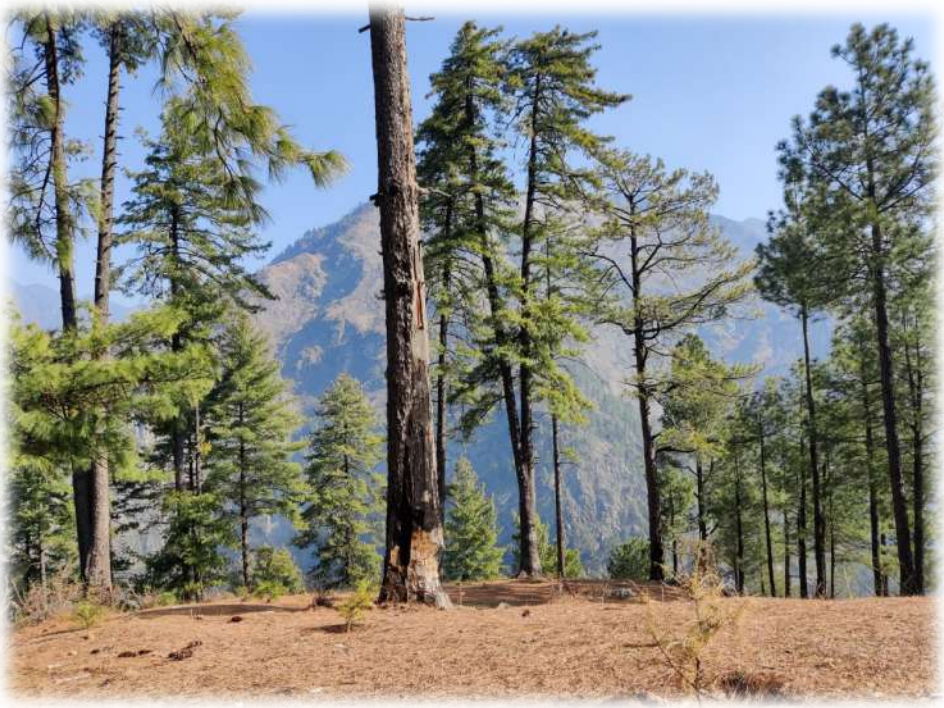
By Jay Parsana

Tint of rays by Bhooma, Ph.D. Scholar

By Jay Parsana

By Jay Parsana

By Jay Parsana



Be like the trees, they stand tall and still even on the edge...

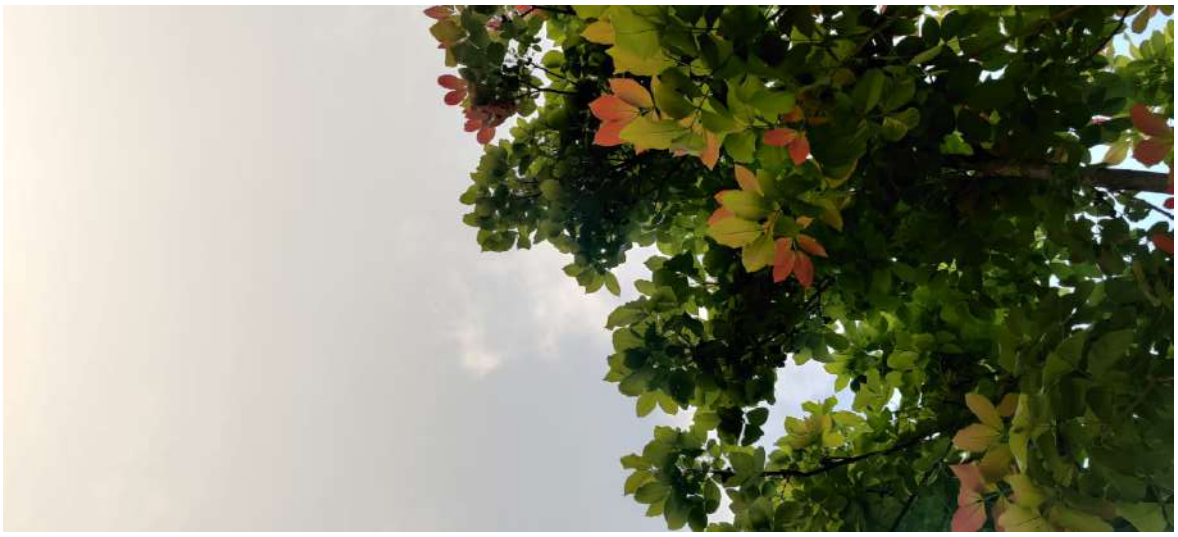
by Meshwa Shah B.Sc. Hons Sem VI

In a journey full endeavours keep up with the clouds...
by Meshwa Shah B.Sc. Hons Sem VI

Sky full of vibrant dreams by Meshwa Shah B.Sc. Hons Sem VI

Dark lights by Bhooma, Ph.D. Scholar

In every walk with nature, one receives more than he seeks…
by Shikha Shah, B.Sc. Hons. Sem IV



Keep close to nature's heart by Shikha Shah, B.Sc. Hons. Sem IV

UPCOMING EVENTS

Department of Chemistry, Physics and Mathematics is jointly organizing a webinar on "**PDEU : A Place for Deep Diving into Science (Counselling Session for Aspiring UG/PG Science Graduates)**" on June 20, 2021

DEEPEST CONDOLENCES

Our BoS member and renowned scholar, Prof B V Kamath had passed away of covid on 9th May 2021 in Baroda We pray for his soul 🙏

Cover by Dr. Rama Gaur
Back Cover by Nikunj Vagadiya