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Indian Institute of Technology Guwahati  
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# ज्ञानवर्षा

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## IIT Guwahati Scientists develop a Strategy to Deliver Chemotherapeutic Drugs specifically to Cancer Cells

Indian Institute of Technology Guwahati researchers have developed a new strategy to deliver chemotherapeutic drugs specifically to the cancerous cells in a patient's body. The path-breaking results of this research have been published in prestigious journals of The Royal Society of Chemistry including 'Chemical Communications' and 'Organic and Biomolecular Chemistry'. The research papers have been co-authored by Prof. Debasis Manna, Department of Chemistry, IIT Guwahati, along with his research scholars Mr. Subhasis Dey, Ms. Anjali Patel, and Mr. Biswa Mohan Prusty, among others. Anticancer activities were carried out in collaboration with Prof. Siddhartha Sankar Ghosh and Ms. Plaboni Sen from the Indian Institute of Technology Guwahati and Prof. Arindam Bhattacharyya and Mr. Soumya Chatterjee from Calcutta University.

A part of the ongoing research was recently highlighted as the cover page of Chemical

Communications.

The problem with existing chemotherapeutic drugs is that they kill healthy cells of the body in addition to cancerous cells, leading to numerous undesirable side effects. In fact, it is believed that cancer deaths are as much due to the side effects of chemotherapy as the disease itself. There is worldwide research to overcome the drawbacks of secondary toxicity of chemotherapeutic drugs. Some strategies that are being explored include target-specific delivery of the drugs and on-demand delivery of appropriate drug doses to cancerous cells/tissues.

Explaining his research Prof. Debasis Manna, Department of Chemistry, IIT Guwahati, said, "We have two needs in the development of chemotherapy drugs - the drug must be targeted at the cancer cells, the drug must be released by an external trigger whenever it is required,"

To meet the above needs, the molecule developed by the research team has four special features.

- > The first feature is that the molecules assemble to form hollow spherical shells in water. These shells that are ten-millionth of a meter in size can be used as a minuscule container for the drug molecule.
- > The second characteristic is that the molecule has a part (the acetazolamide ligand) that specifically binds to cancer cells and not normal cells.
- > The third feature of the molecule is that it has a photocleavable linker moiety that is responsive to infrared light and breaks the shell when exposed to IR.
- > Molecule also contains a dye moiety (cyanine-3) which is also useful for both fluorescence and scattering-based imaging to visually monitor the entire process.

Thus, the molecules developed by the IIT-G researchers self-assemble as capsules to hold the drug, which then attaches only to cancer cells. When infrared light is shone on it, the shell breaks and releases the encapsulated drug into the cancerous cell. The IIT-G scientists rightly believe that their approach would allow the development of drug carriers for chemotherapy with enhanced efficacy and negligible side effects.

The societal impacts of this work cannot be overstated. Given that the number of cancer patients in India is anticipated to be 30 million by 2025, the development of effective chemotherapeutic drugs and delivery systems is critical. The researchers believe that the development of target-specific, light-responsive, self-imaging macrocyclic lipids such as those they've developed could help in image-guided chemotherapeutic applications.

Following the development of the targeted IR (light)-trigger drug release system, the IIT Guwahati researchers are preparing to perform in vivo studies to take this understanding closer to drug development.



(Left) Prof. Debasis Manna, Department of Chemistry, IIT Guwahati, along with his research scholar



# 29<sup>th</sup> Foundation Day



Indian Institute of Technology Guwahati celebrated its 29<sup>th</sup> Foundation Day on September 1, 2022. IIT Guwahati alumni Mr. Aman Mathur delivered a speech during the occasion. As part of the celebrations Prof. Peter Sachsenmeier, President of the International Innovation Center & VC of Hankou University, Wuhan delivered an Institute Lecture on "Advances in Industry 4.0".

The institute on this occasion felicitated retired Faculty & Staff members as a mark of gratitude on the 29<sup>th</sup> Foundation Day of the Institute for their invaluable contribution.

## IIT Guwahati Technology Incubation Centre incubates 42 Start-ups, encouraging an entrepreneurial ecosystem on campus

Indian Institute of Technology Guwahati Technology Incubation Centre (TIC) provides space for new entrepreneurs and young minds to transform innovative ideas into viable business propositions. The Centre provides technical support, business mentoring, and a soft loan facility (subject to availability)

The Centre's goal is to encourage entrepreneurial initiatives amongst the students, faculty and alumni of IIT Guwahati and other individuals interested in entrepreneurship across the country, generate a vibrant business-oriented environment.

The Centre aims to promote advancement in science and technology, traditional knowledge and biodiversity resources, facilitate a platform for entrepreneurship and incubating research mindset for the development of society, and create an interface among researchers, technocrats, and industries.

Speaking about the role of IIT Guwahati Technology Incubation Centre in encouraging start-ups, Prof. T.G. Sitharam, Director, IIT Guwahati, said, "IIT Guwahati through the TIC has embarked on encouraging the students, faculty, staff and other entrepreneurs to provide necessary technological guidance and convert their ideas into products and technology that will be useful to the society and make the country Atmanirbhar".

These incubated startups will work in different sectors such as robotics, information technology, water, oil sector, biotechnology, machine learning, Internet of Things, renewable energy, home automation, and logistics, among other sectors.

IIT Guwahati's TIC is one of the Business Incubators approved and recognized by the Ministry of Micro, Small, and Medium Enterprises (MSME), Government of India. Grant assistance from The Technology Development Board, under the Ministry of Science and Technology, Government of India, has also been approved to support start-ups.

IIT Guwahati TIC is open to all sectors of incubatees/startups and supports them in converting their ideas into successful business ventures. It connects to a pool of experts in terms of faculties, funding agencies such as Oil India Limited (OIL) and Numaligarh Refinery Limited (NRL), among others, and other financial institutions like Indian Bank and YES bank.

Talking about IIT Guwahati Technology Incubation Centre, Prof. Vaibhav V. Goud, said, "IIT Guwahati TIC plays an active role in the North eastern region by serving as a focal point of interaction between venture capitalists, financial institutions, corporates, academicians, university students, and government members. This rich collection of stakeholders allows for an intensive exchange of ideas and enables the creation of quick and efficient solutions to problems that plague young minds."

IIT Guwahati TIC ensures that incubatees have access to technical assistance through mentors with multidisciplinary expertise. The Centre also focuses on the empowerment of women in terms of entrepreneurship; in this regard, it has partnered with NSRCEL-IIMBI for Women Startup Program (WSP). The Center has also partnered with Innovations for Defence Excellence (iDEX) in building the ecosystem for start-ups to interact with the Indian Defence establishment.

IIT Guwahati TIC, established in 2009, is the pioneering incubator in this Northeastern part of India, spread over approximately 4000 square meters of area within the Technology Complex of IIT Guwahati. IIT Guwahati TIC has the adequate infrastructure for this endeavour. It encourages young enthusiasts with creative pursuits with an inherent zeal to be entrepreneurs to take advantage of this novel initiative.

Interaction of IIT Guwahati students with Dr. V. K. Saraswat, Member Niti Aayog, Prof. T.G. Sitharam Director IIT Guwahati and Prof Anil Sahastrabudhe, Former chairman of AICTE



Interaction of Prof. T. G. Sitharam, Director, IIT Guwahati and Deans and Faculty In-charge with the contingent of National Level Common Entrance Examination, 2022 Toppers from Bihar



## IIT Guwahati establishes Centre for Advanced Research on Diagnostics in Cancer

Indian Institute of Technology Guwahati celebrated its 29th Foundation Day on 1st September 2022 by signing a Memorandum of Understanding (MoU) with Karkinos Healthcare Private Limited (KHPL) for research collaboration on Cancer Diagnostics. The MoU was signed between Prof. T.G. Sitharam, Director, IIT Guwahati and Mr. R Venkataramanan, Chief Executive Officer, Karkinos Healthcare Pvt. Ltd.

Under the agreement, a Centre of Advanced Research on Diagnostics in Cancer (C-CARD), a first of its kind in the nation with an IIT, will be set up at IIT Guwahati. The centre will be equipped and operated by KHPL at the IIT Guwahati premises for its establishment. The primary aim of this centre is to work on research related to advanced and affordable diagnostics solutions for non-communicable diseases, primarily Cancer for patients from across the nation.

Speaking during the MoU signing event Prof. T.G. Sitharam, Director, IIT Guwahati, said, "IIT Guwahati aspires to strengthen its Research & Development arsenal and there is no better way to highlight the same in establishing C-CARD by KHPL, in the heart of our institute. In near future, we envision to extend this Centre of Excellence with the activities of Assam Advanced Healthcare Innovation Institute - the upcoming multi-specialty hospital at IIT Guwahati to inculcate next generation scientific and technological innovations in the area of healthcare"

"I sincerely thank Hon'ble Chief Minister of Assam, Dr. Himanta Biswa Sarma and the State Government for their trust in making IIT Guwahati as one of the major knowledge and technology partners in the immediate future.", added Prof. Sitharam during his address.

The MoU signing was a part of the 29th Foundation Day celebration of IIT Guwahati in which both the signing authorities will collaborate on initiatives including:

- > A large-scale OncoDiagnostic services in conjunction with Assam Cancer Care Hospitals across the state to prepare a comprehensive cancer atlas for North-East

- > Establishment of Next-Generation Sequencing (NGS) and Whole Genome Sequencing (WGS) facilities to identify the India specific hereditary origin of this giant killer
- > Capability development on high end data analytics using Artificial Intelligence (AI) and Machine Learning (ML) techniques
- > High quality informatics for research and development through comprehensive genomic landscape identification
- > Capacity development through academic collaboration on clinical excellence
- > Partnerships with biotech and pharma majors

As a part of this initiative, in the near future, IIT Guwahati and KHPL will also collaborate on research projects related to Molecular Biology, Cell Biology, Genomics, Proteomics, Diagnostics, Therapeutics, Bioinformatics, Data Science, Entrepreneurship Development and other multi-disciplinary and translational areas.

Speaking on the occasion, Mr. R. Venkataramanan, Chief Executive Officer, Karkinos Healthcare Pvt. Ltd. said, "The State of Assam has made giant strides in Cancer care under the visionary leadership on Hon'ble CM Dr Himanta Biswa Sarma. Karkinos is pleased to further these efforts and partner with IIT Guwahati in bringing the cutting-edge cancer diagnostics and advanced research to the people of North East. We see this as the first phase of a long and wide-ranging partnership that will redefine cancer care in the region and beyond."

IIT Guwahati aims to work tirelessly for the development of North East region. In this direction, the Institute has collaborated with multiple academic and research bodies of the state to resolve diverse technological issues such as water, education, healthcare and energy problems, flood management, mitigate acid mine drainage in coal mines, to name a few. The Institute's recent collaboration to establish C-CARD is another addition to fulfil this vision.



IIT Guwahati sign MoU with Karkinos Healthcare Private Limited



On 29th Foundation Day, IIT Guwahati signed a MoU with KH PL to serve the Cancer patients

## IIT Guwahati team develops new modelling methods to assess probability of failure of composite materials

Indian Institute of Technology Guwahati research team led by Dr. Nelson Muthu, Assistant Professor, Department of Mechanical Engineering, has developed new modelling methods to assess the probability of failure of composite materials. For this, the researchers have used a combination of Machine Learning tools and state-of-art sampling techniques, to model and predict the failure and other mechanical properties of composite materials used in the aerospace and automobile sector.

This combination of these tools is able to better predict the failure of these materials over the multiple probability technique such as Monte Carlo simulation. The results of the team’s latest work have been published in the prestigious journal, Composite Structures, in a paper co-authored by Dr. Muthu along with this research scholars: Mr. Paladugu Rakesh, Mr. Aditya More, and Mr. Munna Kumar.

Composite materials are made of two or more components and are extensively used in all kinds of aerospace, automobile and construction applications because of favorable properties such as excellent corrosion resistance, high strength and stiffness to weight ratios, durability, increased fatigue life, affordable cost, etc. The simplest type of composite is Fiber-reinforced-Plastics or FRP, which are widely used today. Specialized fiber reinforced composites are used in aerospace, for making specialized aircraft structures. The fuselage, wings, tail, doors, and interior of aircraft, for example, are made of composite materials. The Boeing 787 Dreamliner aircraft is 80% composite by volume, which reduces fuel use by 20-25% compared to its predecessors.

Highlighting the importance of his research, Dr. Nelson Muthu, Assistant Professor, Department of Mechanical Engineering, IIT Guwahati, said, “Despite their wide use, composite materials can fail due to problems such as fibre–matrix debonding, delamination, fiber misalignment, matrix cracking, density variation, broken fibres, impact damage, etc. We need to understand and predict such failures so the composite and the component can be designed accordingly and reduce the risk of failure.”

Computational modelling studies such as Monte Carlo simulations are often used to understand and predict failure of composite materials. However, these multiple probability methods consume a lot of computer time and memory because composite properties are affected by many factors such as the distribution of fibre and matrix characteristics (microscale), laminate bonding (mesoscale), and product macrolevel design (macroscale).

“Although computers are getting more powerful, it is still unrealistic to depend only on single simulation codes to predict properties that are dependent on multiple factors”, said the lead researcher.

The IIT Guwahati team developed a computationally efficient multiscale metamodel-based approach that combines machine learning tools like support vector machines, among others, and sampling tools, such as Latin hypercube, to assess the failure risk in composites with many sources of uncertainty.

While explaining the technicalities of his research, Dr Muthu said, “We performed experiments to determine the uncertainties in the microscale and established the variation of the properties in the mesoscale using the computational homogenization technique within the finite element modelling framework. The uncertainty in the mesoscale was also estimated, and this information was transported to the macroscale simulations.”

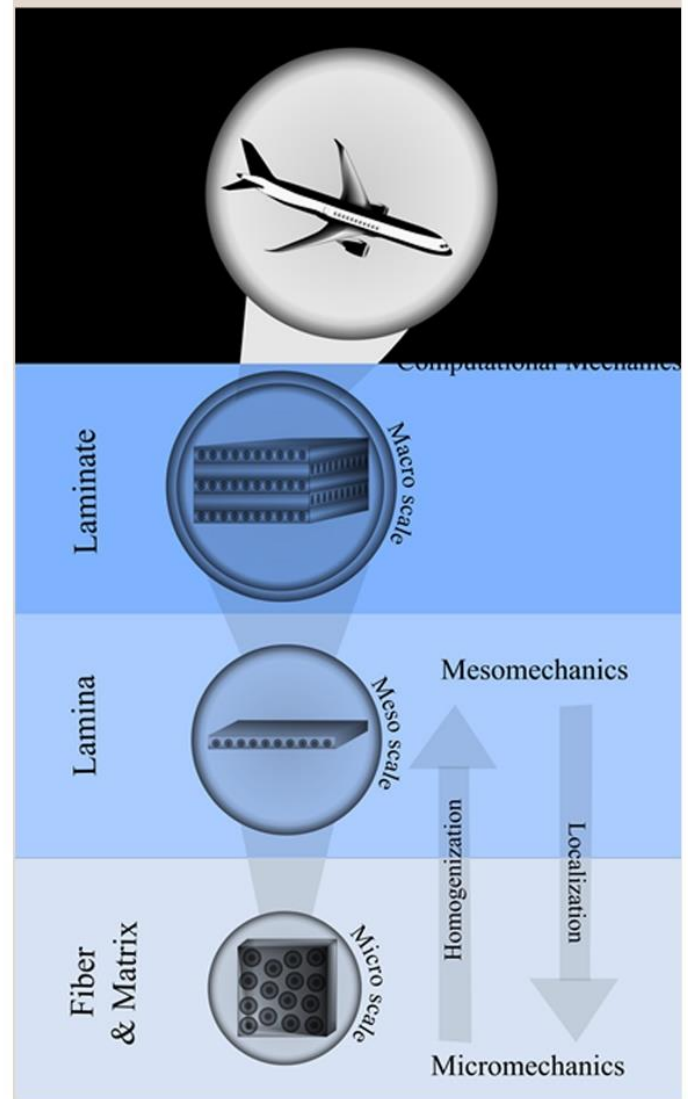


Illustration - Multiscale Modelling

The metamodeling approach reduced the computational effort by about 95% compared to the Monte Carlo simulation. This was also a significant improvement in determining the risk associated with the design and development process.

Apart from this research on the fracture and failure modelling of composites, Dr Muthu's group also works on biomedical device innovation. The researchers routinely collaborate with industry partners like VSSC-ISRO, TATA Steel (TSAMRC), SABIC and Robert Bosch Engineering and Business Solutions Private Limited and work towards solving practical problems in the industry.



Team Picture





# Inaugural Function of Taiwan-India 2022 Exchange Workshop and Symposium (TIEWS-2022) at IIT Guwahati , jointly organized by IIT Guwahati and the National Science and Technology Council, Taiwan.



## Teachers Day Celebration

Teachers Day was celebrated at IIT Guwahati on 5 September 2022. Prof. Pralhad R. Joshi, Vice Chancellor, Kumar Bhaskar Varma, Sanskrit and Ancient Studies University and Dr. B. Amaranath, Registrar, BGS & SJB Group of Institutions, were present as Chief Guest and Invited Speaker along with Prof. Anil Sahasrabudhe, former Chairman AICTE and Prof. T. G. Sitharam, Director IIT Guwahati.



A delegation comprising of H.E. Dr. Shankar Sharma, Ambassador of Nepal, Ms. Nita Pokhrel, Minister (Economic) of the Nepal Embassy, Ms. Marcela Alejandra Zuniga, The Trade Commissioner of Chilli Embassy, Mr. Jukka Ilomäki The Counsellor, Trade & Investment of Finland Embassy, Ms. Junghwa Kim, South Korea Embassy (Research & Development), Dr. Y J Park, Director, Indo-Korean Center for Research and Innovation, New Delhi, Mr. Hyo Hee Lee, Science & Technology attaché at South Korea Embassy visited IIT Guwahati on 6 September 2022. The delegation attended a meeting with the Deans of the Institute to discuss on areas mutual collaboration. The delegation thereafter visited various departments and centres across the Institute.







## Awards & honours



Sourav Kumar, Ph.D. students at IIT Guwahati for being selected for the prestigious Fulbright-Nehru and Fulbright-Kalam fellowships 2022-23



Shreya Katre, Dept. of Civil Engineering has been selected for the prestigious Fulbright-Nehru and Fulbright-Kalam fellowships 2022-23



Ajay Salunkhe, Dept. of Civil Engineering has been selected for the prestigious Fulbright-Nehru and Fulbright-Kalam fellowships 2022-23

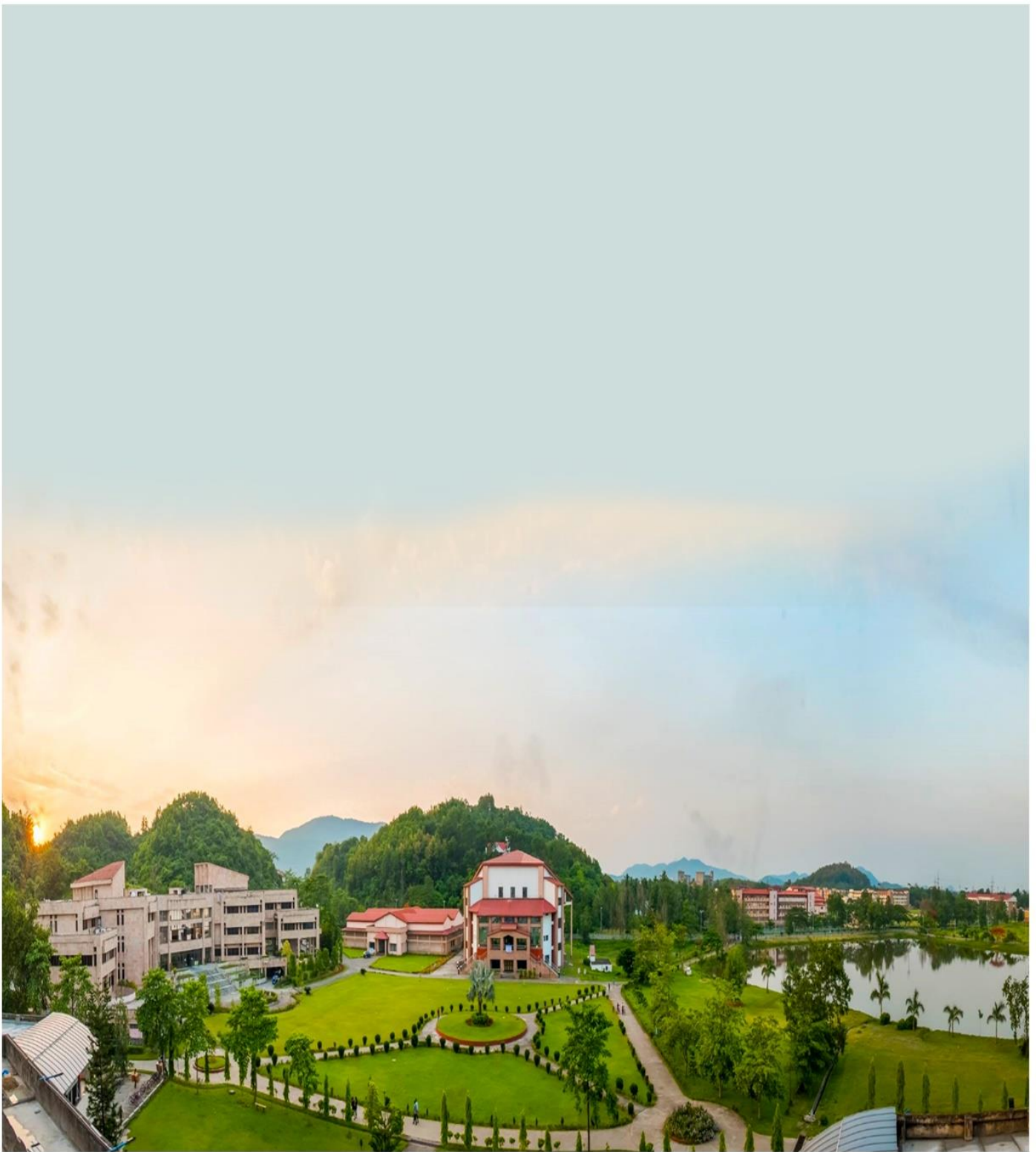


Prof. Shyamanta M Hazarika, Department of Mechanical Engineering has been selected for the prestigious "Abdul Kalam Technology Innovation National Fellowship" by Indian National Academy of Engineering

Glimpses from the Inspection Meeting of first sub-committee of parliament on Official Language during 20-21 September 2022 at Guwahati







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