



भारतीय प्रौद्योगिकी संस्थान गुवाहाटी  
Indian Institute of Technology Guwahati  
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# ज्ञानद्वि

The Monthly Newsletter of IIT Guwahati

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## World's Top 2% Scientists List of Stanford University features 22 researchers from IIT Guwahati

22 faculty members / researchers of Indian Institute of Technology Guwahati have been featured among World's Top 2% Scientists List created by Stanford University and released on 16th October 2020 in the journal PLOS and can be accessed at this link: <https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3000918>.

The report prepared by experts at Stanford University has listed over 100,000 Scientists, whose published research manuscripts have accelerated progress in their respective fields and influenced the productivity of other researcher's work as well.

Led by Prof. T. G. Sitharam, Director IIT Guwahati, the IITG faculty members have been ranked for their research publications citations for the year 2019 and their lifetime contribution to their specific fields of research.

The database report on field specific analysis was prepared by Prof. John P. A. Ioannidis of the Stanford University, USA, and his team and was published in PLOS Biology- prestigious publication forum. The submitted research journals in PLOS Biology publication get a wide spectrum of readers as the publication focusses on publishing highly selective research papers across the various global research reports.

The database was created to provide updated analyses and a publicly available database of 100,000 top Scientists that provide standardized information on citations, h-index (an index to measure an individual's scientific research output), co-authorship-adjusted hm-index, citations to papers in different authorship positions, and a composite indicator. Such citation metric provides a basis to measure and reflect the impact of a published journal.



The IIT Guwahati faculty members featuring in the updated list are from various scientific fields, such as - the Departments of Civil Engineering, Mechanical Engineering, Physics, Chemical Engineering, Biosciences and Bioengineering, Chemistry, Electrical and Electronics.

Speaking about the contributions made by the faculty members of IIT Guwahati, Director T. G. Sitharam said, "This recognition of several faculty in the world's top 2% of Scientists List has placed IIT Guwahati in the global map of Science and has brought great pride to the Institute. I congratulate all the 22 Scientists and their hard-work and commitment to furthering Science."

The following are the researchers from IIT Guwahati who have featured in the list of World's Top 2% Scientists-

1	Ajaikumar B. Kunnumakkara,	Department of Biosciences and Bioengineering
2	Mihir Kumar Purkait	Department of Chemical Engineering
3	Vijayanand S. Moholkar	Department of Chemical Engineering
4	Pravat Kumar Giri	Department of Physics,
5	Biman B. Mandal	Department of Biosciences and Bioengineering
6	Tharmalingam Punniyamurthy	Department of Chemistry
7	Kaustubha Mohanty	Department of Chemical Engineering
8	Shyam Biswas	Department of Chemistry
9	Sanjib Ganguly	Department of Electronics and Electrical Engineering
10	Gautam Biswas (Former Director, IITG)	Professor of Mechanical Engineering
11	Pranjal Chandra	Department of Biosciences and Bioengineering
12	Vaibhav V. Goud	Department of Chemical Engineering
13	Ujjwal K. Saha	Professor of Mechanical Engineering
14	Ajay S. Kalamdhad	Department of Civil Engineering
15	P. Muthukumar	Department of Mechanical Engineering
16	Amarendra K. Sarma	Department of Physics
17	Rakesh Singh Kshetrimayum	Department of Electronics and Electrical Engineering
18	M. Groll (Visiting Professor, IITG)	Visiting Professor, IITG
19	Bibhas Ranjan Majhi	Department of Physics
20	Rajiv Tiwari	Department of Mechanical Engineering
21	Debasish Borah	Department of Physics
22	T. G. Sitharam	Director of Indian Institute of Technology Guwahati

## World's Top 2% Scientists List of Stanford University features 22 researchers from IIT Guwahati



T.G. Sitharam  
Director IIT Guwahati  
Professor, Civil Engineering



G. Biswas  
Former Director - IIT Guwahati  
Professor, Mechanical Engineering



Biman B. Mandal  
Professor  
BioSciences and Bio Engineering



Pranjal Chandra  
Asst. Prof.  
BioSciences and Bio Engineering



A.B. Konnumakkara  
Professor  
BioSciences and Bio Engineering



Mihir K. Purkait,  
Professor  
Chemical Engineering



K. Mohanty  
Professor  
Chemical Engineering



V.S. Moholkar  
Professor  
Chemical Engineering



B. R. Majhi  
Asst. Prof., Physics



P.K. Giri  
Professor, Physics



T. Punoyamurthy  
Professor, Chemistry



S. P. Biswas  
Assoc. Prof.  
Chemistry



U. K. Saha  
Professor  
Mechanical Engineering



R. Tewari  
Professor  
Mechanical Engineering



S. Genguli  
Assoc. Prof.  
Electrical and Electronics Engineering



V.V. Goud  
Professor  
Chemical Engineering



Debashish Bora  
Asst. Prof., Physics



P. Muthukumar  
Professor  
Mechanical Engineering



A.S. Kalamdhad  
Professor  
Civil Engineering



R. Singh Kabirineyem  
Professor  
Electrical and Electronics Engineering



A.K. Sarma  
Professor, Physics



M. Gruit,  
Ex Guest Faculty  
Mechanical Engineering

## IIT Guwahati launches Australia-India Water Centre along with University of Western Sydney in the presence of Shri Gajendra Singh Shekhawat, Union Minister for Jal Shakti

Australia-India Water Centre was inaugurated virtually through a Webinar, in view of the pandemic situation, on November 6, 2020.

Hon'ble Minister Mr. Dan Tehan, Minister for Education - Government of Australia, Hon'ble Shri Gajendra Singh Shekhawat, Jal Shakti - Government of India, Hon'ble Shri B. C. Patil, Minister of Agriculture - Government of Karnataka, His Excellency Shri A. Gitesh Sarma, Indian High Commissioner to Australia, His Excellency Barry O'Farrell AO, Australian High Commissioner to India, Prof T. G. Sitharam, Director - IIT Guwahati, and Directors, Vice Chancellors, Deans of all the partner institutions and many other dignitaries were virtually present on this occasion. The Water Centre is led by University of Western Sydney from Australia and IIT Guwahati from India along with 21 other partners from India and Australia.

The water issues and challenges of India and Australia share many common elements, including natural extremes of floods and droughts, increasing competition for water between urban, peri-urban and rural sectors and increased threats to water security from

climate change. There are also pressures due to the over-exploitation and water quality degradation of surface and groundwater resources. The recent joint declaration at the virtual summit of the Prime Ministers of Australia and India, in June 2020 stated that "Water security is a critical challenge for both countries, and it was jointly decided to deepen policy and technical cooperation on mutually agreed activities to improve water management and sustainable economic development." With this in view, a number of universities, research organisations and business partners from Australia and India have committed to establish the Australia India Water Centre (AIWC).

The MoU signed during this occasion attempts to establish an understanding of cooperation for the Australia India Water Centre (AIWC) between the parties. The Australia India Water Centre will enable Australian and Indian partners to explore opportunities and create synergy for a longer-term collaboration in research and education between the two countries. In particular, the parties anticipate this will include collaboration in water research, a joint Master's level program in water futures, student and staff exchanges, workshops and conferences and provide

short-term training in water sector to government agencies and other participants.

The proposed activities within the MoU (signed for a duration of five years) are to develop longer-term collaboration in water research, capacity building and knowledge and technology transfer, particularly focusing on water and food security, safe drinking water supplies, river health, water-energy-food nexus, water for liveable cities and other related aspects of mutual benefits to Australia and India through:

- (i) The development of tools and techniques to tackle future water and food security challenges including improved management of groundwater, springs, storm water and coastal reservoirs
- (ii) Establishment of a joint Master’s level program in water resources management
- (iii) Capacity building/training programs for government department staff, policy makers, NGOs and industry personnel
- (iv) Promotion of transdisciplinary research and training approach in research and training/educational program
- (v) Promotion of water expertise of the Centre partners which expands engagement and networking internationally

Speaking at the webinar organized on this occasion, Shri Gajendra Singh Shekhawat, Union Minister of Jal Shakti, Government of India, said, “I am delighted to inaugurate the Australia India Water Center (AIWC) to promote water related research, teaching and training between the two countries in the presence of officials and experts from the water sector of India and Australia. My wishes for making this collaboration towards water sustainability successful!”

Highlighting the benefits of this partnership, Prof. T. G. Sitharam, Director, IIT Guwahati, said, “Water is likely to play a key economic and strategic role in the future. This Centre will focus on collaboration in transdisciplinary research, capacity building and knowledge and technology transfer, particularly on aspects of water and food security, safe drinking water supplies, river health, water-energy-food nexus, water for liveable cities and other related facets of mutual benefits to Australia and India”

The core partners of this MOU include:

Australia	India
<b>Western Sydney University (Lead)</b>	<b>Indian Institute of Technology Guwahati (Lead)</b>
Deakin University	Banaras Hindu University, Varanasi
Flinders University	GB Pant University of Agriculture & Technology, Pantnagar
Queensland University of Technology	Indian Institute of Science Bangalore
The University of Melbourne	Indian Institute of Technology Kharagpur
University of New South Wales	Indian Institute of Technology Roorkee
The University of Western Australia	Jawaharlal Nehru Technological University, Hyderabad
University of Wollongong	Maharana Pratap University of Agriculture & Technology, Udaipur
Department of Environment and Water, Government of South Australia	National Institute of Hydrology, Roorkee
	National Institute of Technology Surathkal
	SV National Institute of Technology Surat
	University of Agricultural Sciences, Bangalore
	Institute of Rural Management, Anand
	Indian Institute of Information Technology Dharwad
	JSS Science and Technology University, Mysuru



AIWC Launch

## IIT Guwahati Scientists make Breakthrough in Developing Efficient Catalytic Systems for Biofuel and Lactic Acid Production

A research team led by IIT Guwahati Professors, Dr. Akshai Kumar Alape Seetharam, of the Department of Chemistry and Centre for Nanotechnology, Dr. Hemant Kumar Srivastava, currently at National Institute of Pharmaceutical Education and Research (NIPER) Guwahati, research scholars Kanu Das, Moumita Dutta, Siriyara Jagannatha Prathapa, Eileen Yasmin and Dr. Babulal Das, have formulated efficient “pincer” catalytic systems that transform industrial/biomass wastes into valuable chemicals. Tiny amounts of these “pincer catalysts” repeatedly convert large amounts of industrial waste such as glycerol into lactic acid and hydrogen. Such catalysts also efficiently convert bioethanol, a low-energy density fuel into high-energy density butanol.

The conversion of valuable intermediates such as glycerol and ethanol, produced during the processing of biomass, into industrially useful chemicals has elicited much interest worldwide. Glycerol, for example, which is a by-product in biodiesel production, can be transformed into lactic acid and hydrogen, the former used extensively in food, pharmaceutical, cosmetic and polymer industries, and the latter in the energy sector. Likewise, ethanol obtained from biomass can be converted into high quality fuel. While bioethanol has lower energy density than gasoline and corrodes engine parts when used directly, it can be transformed into higher energy butanol that is immiscible in water and noncorrosive in nature. The conversion of glycerol and ethanol into such useful products hinges on the development of efficient catalysts that can bring about these transformations.

Dr. Akshai Kumar and Dr. Hemant Kumar Srivastava work towards the development of catalysts that can bring about such industrially important transformations. They have recently developed efficient ‘pincer catalysts’ that selectively convert glycerol to lactic acid and bio-ethanol to butanol.

“Pincer catalysts are complex molecules in which, an organic moiety holds on tightly to a metal core, much like the claws of a crab”, explains Dr. Akshai Kumar, adding that such an arrangement not only confers stability to the catalyst, but also selectivity to bring about the intended transformations.

The research team rationally designed and tested a large library of “pincer catalysts” to be used for

these transformations. The experiments were carried out under environmentally benign conditions without the use of hazardous reagents and solvents. The most efficient “pincer catalyst” was found to be one that had least crowding around the metal centre. Such an arrangement enabled easy removal of hydrogen from the starting materials, glycerol and ethanol, and their selective conversion into lactic acid and butanol, respectively.

The results of the experiments have been validated by theoretical studies. “Our computational studies have attributed the unprecedented activity of the pincer catalysts to the minimal crowding present at the metal centre and have enabled good understanding of the electronic and steric (crowding) factors that control reactivity,” says Dr. Srivastava

“This catalyst is active over several thousand cycles without loss in efficiency,” says Dr. Akshai Kumar. He adds that the generation of hydrogen in the conversion of glycerol to lactic acid is a bonus, given its enormous demand in energy applications.

The findings have recently appeared in the Royal Society of Chemistry journals, Chemical Communications and Catalysis Science & Technology. The research team plans to take these bench-scale reactions to pilot-plant scale and ultimately to the commercial level with industrial collaboration. The research team believes that the work will have a global impact on the commercial production of lactic acid/biofuels and their multi-billion-dollar market worldwide.

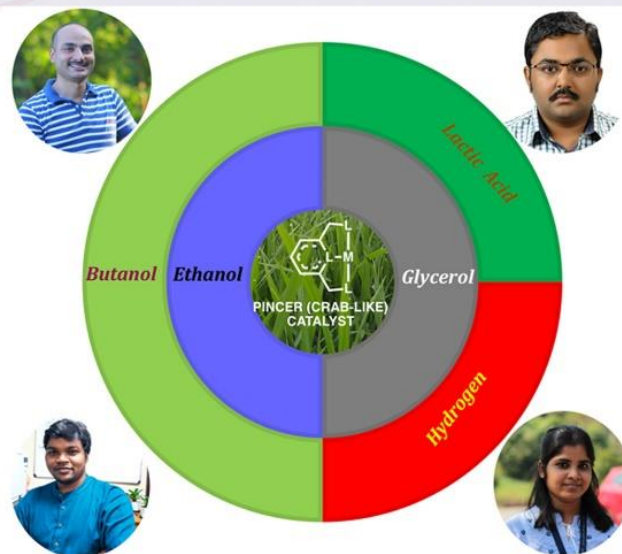


Photo of Researchers

## IIT Guwahati Scientists Report Advanced Free Space Communication System using Light Beams for Error Free Data Transmission

A research team led by IIT Guwahati faculty, Dr. Bosanta Ranjan Boruah, Department of Physics, IIT Guwahati, and Dr. Santanu Konwar, presently an Assistant Professor at the Department of Physics, Abhayapuri College, Assam, has developed a novel free-space optical communication system for information transfer. In free-space communication, data in the form of voice, text or image is transmitted using light wirelessly rather than through optical fibres and it represents the next generation of communications technology. The results of this path-breaking work has recently been published in "Communications Physics (<https://www.nature.com/articles/s42005-020-00468-1>)" a highly reputed journal belonging to Nature Publishing Group.

The past couple of decades have seen phenomenal developments in free-space communication. Most free-space communication systems developed so far all over the world use a type of light beam called the vortex beam to encode the data. The problem in the use of vortex beam is that it can be distorted by turbulence that may occur in the medium of propagation. In effect, data transmitted wirelessly using light/laser beams, can become corrupted when transmitted through atmospheric turbulence such as wind. To overcome this problem, the IIT Guwahati researchers have, for the first time, used orthogonal spatial light modes called Zernike modes to encode the data and to transmit the same robustly in the form of the phase profile of a laser beam.

Explaining the technicality of the research, Dr. Bosanta Ranjan Boruah, Department of Physics, IIT Guwahati says, "In our work, the transmission station modulates the phase profile of a laser beam that carries the data, in terms of the strengths of a few Zernike modes. In the process we also enhance the information content per modulation cycle of the laser beam."

At the point of reception, the laser beam with encoded user information is sensed by a specially designed wavefront sensor that decodes the user information. In this communication system, a unique mechanism has been implemented that can compensate for the effect of atmospheric turbulence, so that the user information can be transmitted even through turbulent atmosphere resulting in negligible error at the receiving station.

"In addition to eliminating errors in communication, our system is also insulated from hacking and interloping, because the receiver decodes the transmitted beam by measuring the phase and not the power of the light beam, with prior knowledge about the strength and types of Zernike modes used, which make it more secure than wired and other conventional wireless forms of communication", says Dr. Santanu Konwar, presently an Assistant Professor at the Department of Physics, Abhayapuri College, Assam. Furthermore, the transmission is directed strictly towards the receiver, unlike other wireless forms of communication in which the information is transmitted in all directions, adding to the security of the communication.

The research team has demonstrated the distortion-free transmission of text messages and images over distance of one kilometre even in the presence of turbulence such as during a stormy weather. The communication system can thus be used for high speed and secured communication between two individuals located either inside a building or outside.

*An artistic view of the proposed free space optical communication system depicting information transfer through a turbulent medium.*



Dr. Santanu Konwar



Dr. Bosanta R Boruah

## IIT Guwahati signs MOU with IIT (BHU) Varanasi to offer Joint Doctoral Programmes

A Memorandum of Understanding (MoU) has been signed between IIT Guwahati and IIT (BHU) Varanasi on 27th November 2020. Under this MoU, IIT Guwahati and IIT (BHU), Varanasi will start Joint Doctoral Programme in July 2021. Directors of both the Institutes, Prof. T. G. Sitharam, Director, IIT Guwahati, and Prof. Pramod Kumar Jain, Director, IIT (BHU) said that this is the first time in the country that two IITs have come together to offer a joint degree programme.

The idea of a joint PhD programme was originally proposed by Prof. T. G. Sitharam in 53rd IIT Council Meeting held on 27th September 2019. The vision behind this is to build a "Network of Excellence" of all IITs rather than each one striving to become a "Tower of Excellence". The IIT Council accepted the proposal to start Joint Degree Programs. Through this academic collaboration, both the institutes are expecting significant boost in high quality research and foundation for further academic collaborations.

Under the National Education Policy (NEP2020), such educational reforms and academic collaborations between premier educational institutes will promote multidisciplinary academic programs and research for encouraging and promoting a knowledge-based economy of the country. IIT BHU is considering starting a Joint MTech program on similar lines to provide multi-institutional and multidisciplinary MTech programs. IIT Guwahati has also agreed to be part of this initiative.



## IIT Guwahati and CSIR-North East Institute of Science and Technology, Jorhat sign a Memorandum of Understanding for the dissemination of Science in North East India and conduct advanced research

IIT Guwahati and CSIR-North East Institute of Science and Technology (CSIR-NEIST), Jorhat have signed a Memorandum of Understanding (MoU) on 17th November 2020 at IIT Guwahati. The MoU will enable IIT Guwahati and CSIR-NEIST to collaboratively work on jointly offer training programs and carry out advanced research in the areas of Disaster Management and Water Resources.

Prof. T. G. Sitharam, Director, IIT Guwahati, said that IIT Guwahati will jointly organise training programmes for the teachers from North East to promote the dissemination of Science through online courses and interaction from the next academic year.

Dr. Narahari Sastry, Director CSIR-NEIST, expressed keen interest in offering a course on Application of Machine Learning in Science and work on joint research projects in the areas of Bioresources and Chemistry.



IITG CSIR-North East Institute of Science and Technology, Jorhat sign MOU

## IIT Guwahati faculty Prof. Biman B. Mandal awarded the prestigious Swarna-Jayanti Fellowship by Department of Science and Technology for the year 2019-2020 in "Life Science" category for his notable research in the area of Tissue Engineering and Regenerative Medicine

"The Swarnajayanti Fellowships" were instituted by the Department of Science and Technology (DST), Government of India, to commemorate India's 50th year of Independence. Under this scheme a selected number of young scientists with proven track record are provided special assistance and support to enable them to pursue research in frontier areas of science and technology. IIT Guwahati's faculty Prof Biman B. Mandal has been awarded the prestigious Swarnajayanti Fellowship.

As a part of the SwarnaJayanti Fellowship, winners are awarded top up salary and high value research funds for next 05 years to allow pursue unfettered research with high degree of freedom and flexibility.

During the Fellowship period, Prof. Mandal will be working on a project titled "Modelling human liver microarchitecture and cellular physiology in vitro using 3D bioprinting for drug toxicity and high throughput drug screening applications."

Project Summary: Developing a drug against a disease is a time-consuming process (approximately 17 years) which generally begins with identifying suitable drug candidates, followed by their preclinical and clinical studies. After entering the human body, most of the drugs pass through the liver for their breakdown followed by excretion or elimination through urine or bile. However, at times the processed drug by-products are toxic to liver cells resulting in acute liver failure, commonly known as drug-induced liver injury (DILI). DILI has been a major reason for several FDA approved drugs to be withdrawn from the market. Approximately, DILI affects millions of people worldwide and is a leading cause of acute liver failure. Currently, the gold standard approach for the drug toxicity assessment is the use of animal and rodent models. However, animal models show variation in drug metabolism due to difference in species, age, gender, liver physiology. To overcome this shortcomings, preclinical in vitro human liver models which mimic the native human liver, could be a potential solution to assess the drug toxicity with superior accuracy. These models would lessen the number of drug candidates taken forward for human trials and improve the clinical efficiency and lower

costs. The proposed in *vitro* 3D bioprinted human liver model would help the pharmaceutical companies to speed up the drug development process allowing high throughput screening with reduced associated animal costs. Lives of millions of animal could be saved in the process which are currently used as experimental models if an alternative human liver model becomes reality. Expected outcome/deliverables: A spinoff to be formed down the lane offering multiple "off the shelf in vitro liver models" to pharmaceutical companies for high throughput drug screening applications.



Prof Biman Mandal

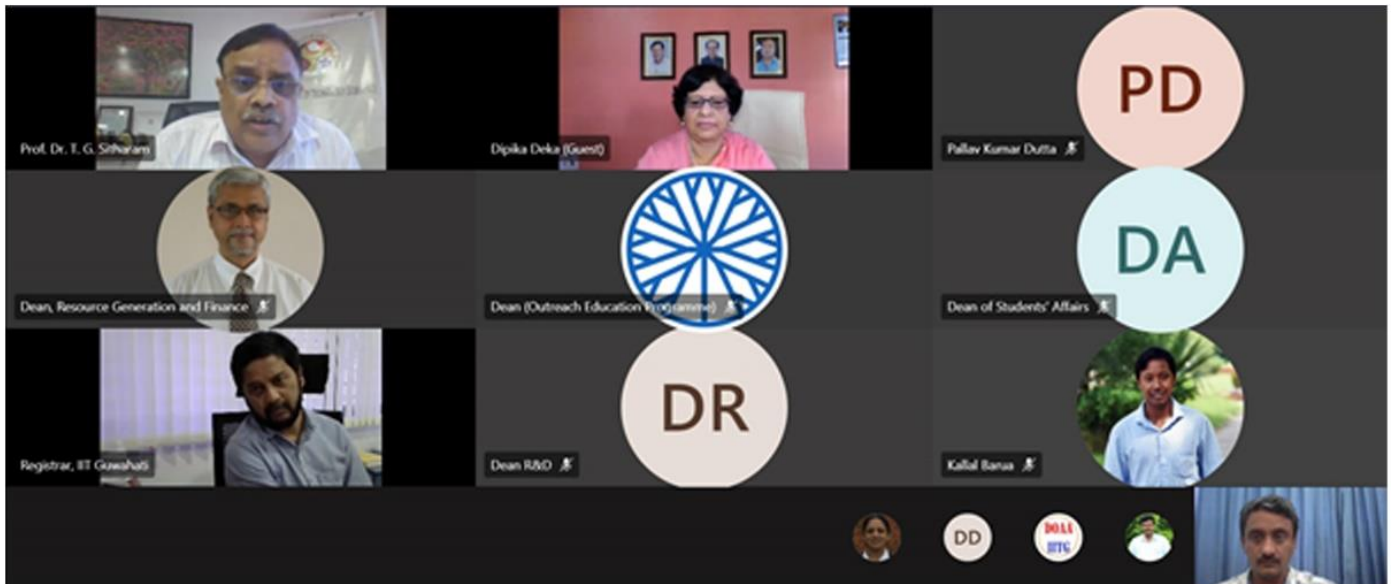


Dr. Uttam Manna Department of Chemistry and Center for Nanotechnology, IIT Guwahati has been awarded the "Humboldt Research Fellowship for Experienced Researchers" by the Alexander von Humboldt Research Fellowship for Experienced Researchers" by the Alexander von Humboldt Foundation, Germany.



Prof. Siddhartha Pratim Chakrabarty of Dept. of Mathematics, IIT Guwahati has been selected for "Scholarship Scheme for Faculty Members from Academic Institutions - 2020" of RBI.





To Commemorate the Birth Anniversary of the first Minister of Education of Independent, Maulana Abul Kalam Azad, National Education Day was celebrated at IIT Guwahati through video conferencing with Prof. Dipika Deka, Vice Chancellor, Srimanta Sankardeva University of Health Sciences attending as the Chief Guest on the occasion.



The Director, IIT Guwahati, Prof. T. G. Sitharam, on November 10 inaugurated the IIT Guwahati Covid-19 Screening Centre and the IIT Guwahati Isolation Facility for Covid-19 positive patients. These facilities are meant exclusively for students, employees and campus residents of IIT Guwahati.

The IIT Guwahati Covid-19 Screening Centre which has been set up after due approvals from the concerned authority can conduct both RAT and RT-PCR tests free of cost.

The IIT Guwahati Isolation Facility, with about 40 rooms will cater only to pre-symptomatic /asymptomatic/mild symptomatic Covid-19 cases under the supervision of the IIT Guwahati Medical Team.



Prof. T. G. Sitharam, Director, IIT Guwahati inaugurated the office of II&SI and felicitated the winners of "Grand Ideas to Tackle Covid-19 Challenge" in the presence of Prof. Sashindra K. Kakoty, Deputy Director, Prof. G. Krishnamoorthy, Dean, II&SI and Prof. P. Muthukumar, Associate Dean, II&SI, IIT Guwahati, on 12th November, 2020.



On the occasion, a liquid surface disinfectant prepared on the technology developed by Prof. Biman B. Mandal, Dept. of BSBE and his team at IIT Guwahati was handed over to the Deputy Director of IIT Guwahati for disinfecting the campus.

## North East Green Summit

The 5th edition of North East Green Summit was inaugurated by the Hon'ble Chief Minister of Assam Shri Sarbananda Sonowal on November 16 in presence of Director IIT Guwahati, Prof. T. G. Sitharam.

Shri Rameswar Teli, Hon'ble Union Minister of State, Ministry of Food Processing Industries, Dr. Rajdeep Roy, Hon'ble Member of Parliament, Silchar, Assam, Dr. Rajkumar Ranjan Singh, Hon'ble MP, Lok Sabha, Manipur, Shri Chandra Mohan Patowary, Minister, Industries and Commerce, Assam, Shri C.P.Marak, IFS (Rtd.) and Advisory Board Member, Northeast Green Summit, Dr. Chandrashekhar Deshmukh, President, Kokuyo Camlin Ltd. are also present in the inauguration ceremony.

Dr. Harsh Vardhan, Hon'ble Union Minister of Health and Family Welfare, His Excellency Major General Vetsop Namgyel, Ambassador, Royal Bhutanese Embassy, New Delhi, Shri Atul Bagai, Country Head, United Nations Environment, Prof Ashutosh Sharma, Secretary, Ministry of Science & Technology, Govt. of India also delivered video message on the occasion.





Constitution Day also known as 'Samvidhan Divas', is celebrated in our country on 26th November every year to commemorate the adoption of the Constitution of India. On 26th November 1949, the Constituent Assembly of India adopted the Constitution of India, which came into effect from 26th January 1950.

Like every year IIT Guwahati joined the entire nation to celebrate this auspicious day.



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