



INDIAN INSTITUTE OF TECHNOLOGY
MADRAS
OFFICE OF ALUMNI AND CORPORATE
RELATIONS

Celebrating the Generosity of Shri Lakshmi Narayanan and Smt. Lakshmi

Impact of your giving in 2024

Director's Message



Prof. Kamakoti Veezhinathan

Director, IIT Madras

Greetings!

IIT Madras continues to retain her top position for the eighth consecutive year, in the National Institute Ranking Framework, thanks to the world-class research of its faculty and students. The contribution and support of Alumni and well-wishers like you has crucially helped this standing and stature. Our achievements in research, education, innovation and entrepreneurship have also earned us the recognition of an 'Institute of Eminence' as well as the top position in the Atal Innovation Ranking from the Government of India.

The institute is making an indelible mark with her 'research with impact' in several areas including quantum computing, drinking water technology, industrially relevant mathematical models for governance, rendering cancer-cure more effective. Our centres of excellence, the Center for Innovation, Nirmaan – the pre-incubator, the Incubation Cell, technology centres such as 'IITM-Pravartak' and others, work in unison for not just our nation's building, but societies world-wide. We aspire to be locally impactful and globally relevant through all these efforts.

Towards exploring new research frontiers, a Department of Medical Sciences and Technology has been launched in May 2023 to conjoin medicine and engineering. Similarly, a School of Sustainability was also created in October 2023 to research sustainable practices in the Global South.

The campus is moving towards a 'carbon-net-zero' goal through water conservation by 100% recycling, efficient garbage disposal, and electrification of vehicles. The traditional education system is undergoing a paradigm shift, with our online Bachelor of Science programme in Data Sciences and the National Program of Technology Enhanced Learning, that have won Gold in the 'Lifelong Learning' category and Silver in the 'Best Online Program' category of the Wharton-QS Reimagine Education Awards 2022 respectively. IIT Madras is leading this revolution from the front.

Such achievements are not possible without the deep-rooted faith and support of alumni and well-wishers such as yourself. We are indebted to you for your generous, bountiful, and impactful contributions. On behalf of IIT Madras, I offer you our deepest gratitude for continuing to strengthen the Institute. Together with your support, we are confident of building an IIT Madras that is more inclusive, diverse, and enabled by an ecosystem to be nationally relevant and globally recognised.

Thank you!

Dean's Message



Prof. Mahesh Panchagnula

Dean, Alumni & Corporate Relations, IITM

Greetings!

I express my heartfelt gratitude to you for your generous support to IIT Madras. We appreciate your passion in supporting the causes you do and I assure you that your contributions will be optimally utilized. This report has been compiled to convey how your largesse has touched lives and made a difference at IIT Madras. In keeping with the rapid, contemporary strides in science, technology we have set ambitious goals for ourselves - your continued enthusiasm and support will help us greatly in these endeavors.

IIT Madras is far more diverse in its set of pursuits, more green and more research-focused. And yet, it remains unchanged over these years, it is still the best Institute in the country, and attracts the best students that India has to offer to come and make a mark. I also cordially invite you to visit your campus to see for yourself, the impact of your contribution, and the growth and transformation the Institute has undergone over the years. We can never express our gratitude enough for all that you have done - Thank You!



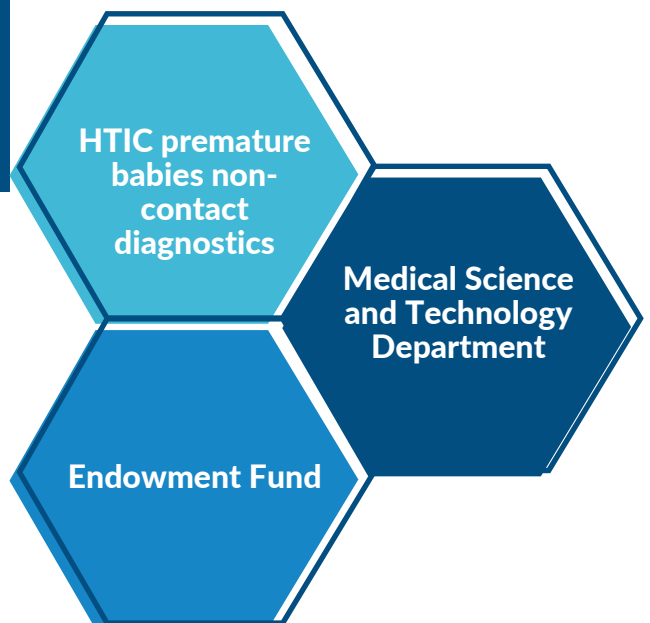
"GIVING IS NOT JUST ABOUT
MAKING A DONATION -
IT'S ABOUT
MAKING A DIFFERENCE"



Shri Lakshmi Narayanan

Co-founder
Cognizant Technology

The report will present a thorough assessment of the impact that your contributions have made towards:



HTIC premature babies non-contact diagnostics

Non-contact monitoring is the measurement and continuous monitoring of vital signs and body activity using cameras and unobtrusive sensors. The most important application is in neonatal ICUs involving pre-term infants of 24-34 gestational ages (GA). These infants have very fragile skin where the use of contact probes cause skin erythema and discomfort. The present limitations of non-contact technology are poor accuracy and low temporal coverage due to patient movement and other ambient factors. These limitations prevent them from being a clinically accepted mode of measurement to replace the existing contact-based techniques. In addition, the behavioural assessment to generate a wellness score, like the Brazelton score, performed by the nursing staff is a point-period measurement with inherent subjectivity. A camera based continuous monitoring system can significantly reduce the subjectivity and missed assessments.

Our objective is to develop a multimodal, multi-channel non-contact monitoring platform for ICUs with smart sensor fusion algorithms to improve accuracy and temporal coverage. Implement automated behavioural detection and assessment techniques as a replacement for point-period assessments. A large amount of data is planned to be collected to use AI based techniques to optimize the multiple channels required for maximum temporal coverage. The developed platform will be robust to instil confidence in clinicians and to eventually replace existing contact-based techniques.

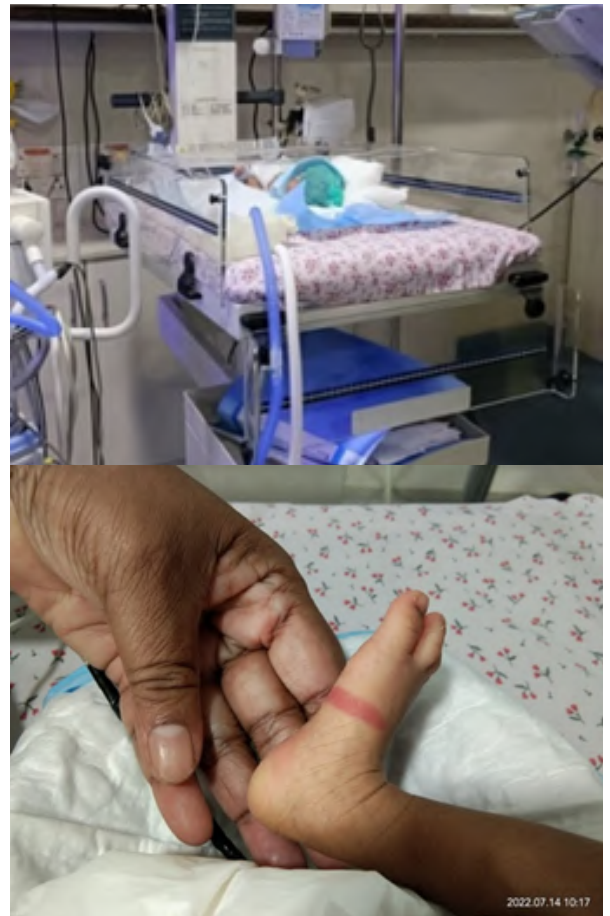


Fig. 1: Left: Typical clutter of wires and cables in Neonatal ICUs (NICU) which can cause skin abrasion and infection. Middle: Skin erythema due to a pulse oximeter probe. Right: Proposed multimodal, multi-channel setup.

Impact Created

01

Development of multi-modal setup for NICU data collection – A multi-modal non-contact measurement setup has been designed to be fixed on a rotatable mount on a radiant warmer. The measurement setup can be moved around to make way for care-giver access. The modalities include colour camera (for day), night vision-NIR camera (for night) and thermal imager. A generic USB webcam is also added to capture the ground truth information from a patient monitor.



Fig. 2: Rotatable non-contact data-collection set-up designed for monitoring on a radiant warmer. The measurement setup can be moved around to make way for care-giver access. The setup consists of four different cameras

02

Custom development of image and signal processing techniques using classical and DL based techniques – Multiple algorithms have been developed to obtain reliable values of heart rate from facial PPG, respiration rate from ballistic chest movement as well as temperature differential during respiration, in addition to anthropometric data.

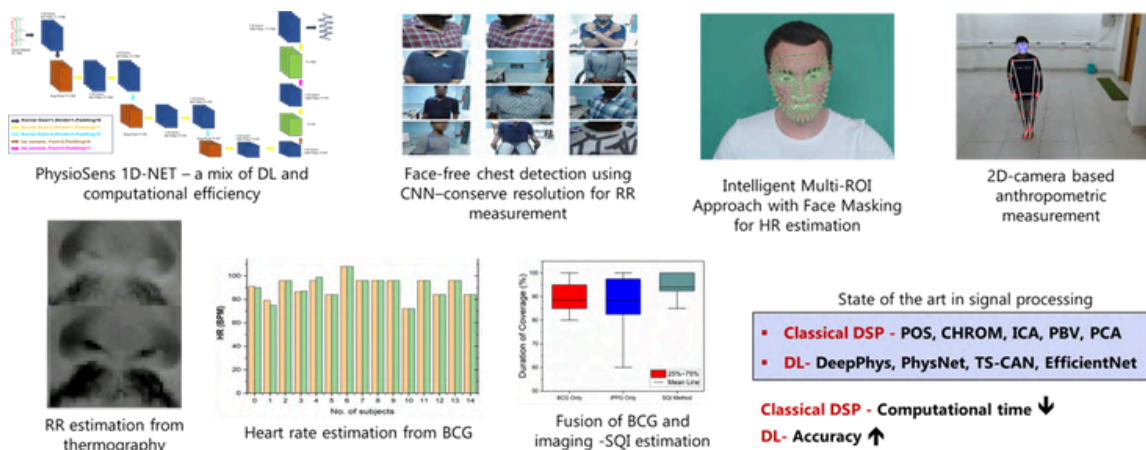
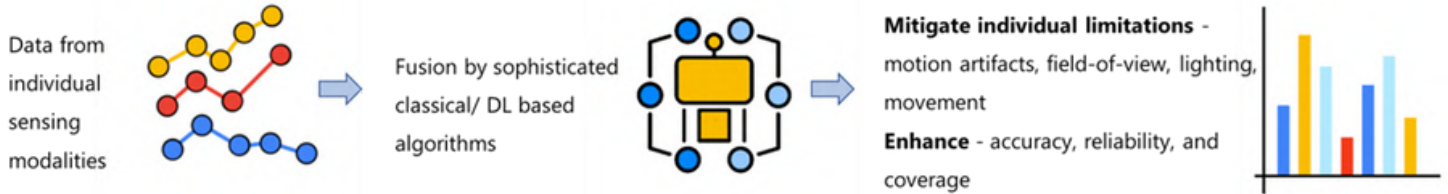


Fig. 3: An overview of classical and DL based methods custom developed for non-contact measurement.

03

Sensor fusion – Robust signal quality (SQ) estimation algorithms have been developed to estimate the reliability of the physiological parameter it measures. This is a real-time estimate as the signal can degrade due to ambient noise and motion artefact. Smart sensor fusion algorithms use the SQ values to provide reliable values from the multimodal data.



04

Data collection platform – A database based data collection platform has been custom developed to acquire and host a large amount of data that is expected to be collected during the field studies at NICU. The platform can collect data from multiple study locations real-time and includes a user interface for visualization. Further ML/DL algorithms can be developed by researchers by accessing this data. Till now, data has been collected from 100 volunteers for validation studies.

05

Publication – This work has resulted in seven international conference publications

- *Face-Free Chest Detection Using Convolutional Neural Networks for Non-Contact Respiration Monitoring (presented at EMBC 2023).*
- *Unsupervised Enhancement of Classical rPPG Algorithms using 1D-CNN and Contrastive Loss for Accurate Non-Contact Heart Rate Estimation (presented at MeMeA 2024).*
- *Effect of Sitting Posture on Systolic Phase of Cardiac Cycle Derived from Strain Gauge based Ballistocardiogram (presented at MeMeA 2024).*
- *PhysioLSTM: A Novel 1D Architecture for Non-Contact Heart Rate Monitoring (presented at MeMeA 2024).*
- *PhysioSens1D-NET: a 1D Convolution Network for Extracting Heart Rate from Facial Videos (presented at EMBC 2024).*
- *Enhancing Non-Contact Heart Rate Monitoring: an Intelligent Multi-ROI Approach with Face Masking and CNN-Based Feature Adaptation (presented at EMBC 2024).*
- *Fusion of Ballistocardiography and Imaging for Improved Non Contact Heart Rate Monitoring (presented at EMBC 2024).*

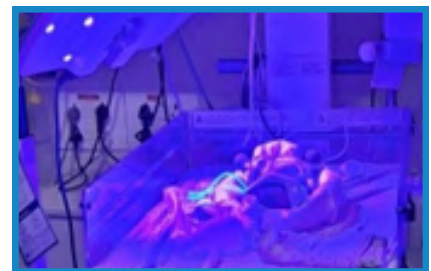
Plan Ahead

The developed non-contact technology platform is presently in the sensor fusion and signal quality estimation stage. Post this; the platform is ready for clinical validation in a partner hospital's NICU. Necessary ethics committee approvals will be obtained. The platform will also be tuned real-time for issues that will be observed in a field scenario (listed in Fig. 4).



Infrared based temperature measurement in presence of radiative loss preventing **plastic covering**

SPO2 measurement in presence of high intensity **external light sources** like phototherapy equipment



Measurement of camera based vitals when the neonate is in **prone position**, covered

Vitals measurement in presence of **CPAP cover**, cannula obstructing field of view



Medical Science and Technology Department

About the department:

The Department of Medical Sciences and Technology at the Indian Institute of Technology Madras was established in February 2023. The Department aims to set up a world-class research environment for medical sciences and technology to develop and train Physician Scientists and Engineering Physiologists of the future.

By applying engineering principles to medical knowledge, this new breed of professionals who transcend medicine and engineering have the potential to revolutionise healthcare delivery both in hospital settings and outside. With a combination of the principles of design, bio-mechanics, electronics technology and the science of ergonomics, powerful medical devices can be developed that enhance the efficacy, safety, and reliability of medical treatments.

The Department aims to build a platform for the convergence of engineering teams and medical professionals where products are developed with a clear understanding of the unique needs of patients, how a device might interact with various medical treatments, and pre-existing conditions of the human body.

With this interdisciplinary approach to improving healthcare outcomes by leveraging engineering and medical knowledge, new technologies can be developed that monitor vital parameters of various organs, detects signs of disease or stress, and provides targeted prevention and treatment options. As engineering and medicine continue to converge, the possibilities are endless. With the right platform and resources, Physician Scientists and Engineering Physiologists will be able to create groundbreaking technology that have a positive impact on patients' lives for generations to come.

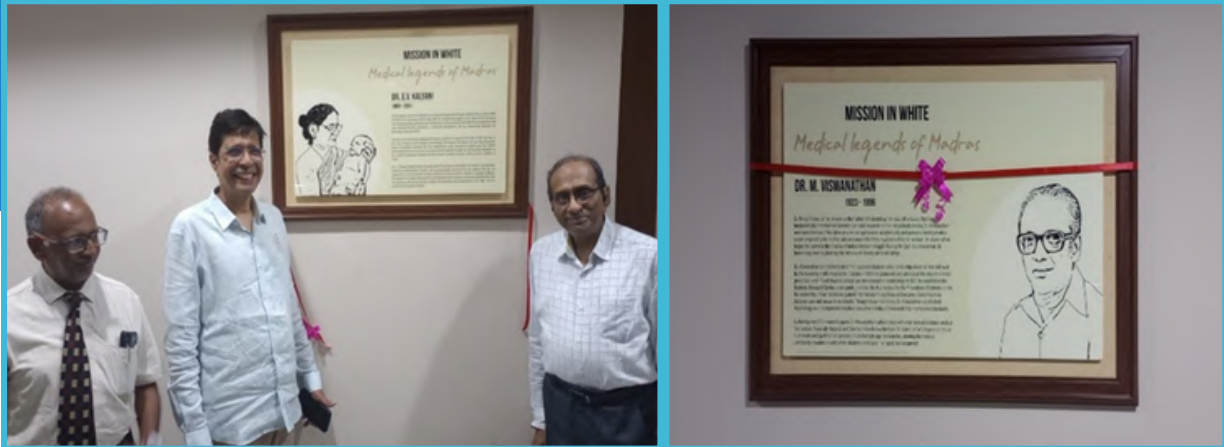
IITM has entered into MoUs with highly respected medical institutions to begin its PhD Programme and BS in Medical Sciences & Engineering Programme. The affiliated hospitals include Voluntary Health Services, Sankar Nethralaya, MGM Healthcare, MIOT International, SRIHER, MMM Hospital and KK CHILDS Trust Hospital.



Visit and meeting of Dr. Brian Kobilka (Nobel Prize Laureate for Chemistry, 2012) with DMST Staffs

Mission in white Project:

A tribute to the real unsung medical stalwarts who have contributed to the medical science at large during their lifetime with innovative and disruptive technology of their times. Identifying the contributions of these legends, DMST created a series of portraits to be placed in the department corridor and got it inaugurated by the family members of the late legends.



Academics

Courses offered by the Department:

Four Year BS Programme in Medical Sciences & Engineering

The BS Programme in Medical Sciences & Engineering is a game-changing interdisciplinary programme that bridges Medicine & Engineering.

The course structure involves an internship in a hospital to tie theory and practice. The courses in the programme will be taught by both medical & engineering faculty and will provide a strong research base for students.



23' BS First Batch Induction program with Director, IITM

The Structure of Physiology Courses offered by the programme include:

- Anatomy and Physiology of Organs
- Mathematical Modelling of the Organ System
- Pathology of the Organ System and its interaction with other systems
- Diagnostics / Measurement system and Treatment Protocols



Hands on learning of Anatomy through cadaveric dissection



Microbiology practical's session



Hierarchical cellular structure practical's session

The Programme will cover the following broad areas:

- Basic engineering principles that are necessary to understand physiology
- Fundamental sciences to understand physiology
- Basics of mathematical methods, machine learning, medical imaging, etc to build mathematical structure

Specialisation in one or more of the following areas:

- Organ-specific Device Development
- Artificial Intelligence applied to Health
- Medical Image Analysis
- Quantitative Pharmacology
- Drug Design and Deployment
- Translational Research in Medicine and Regulatory Processes
- Fundamental Physiological Sciences

Department's upcoming Lab Infrastructure



BS learning anatomy students through Anatomage



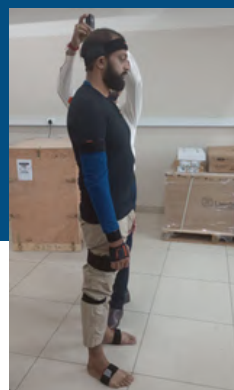
Neonatal Mannequin



Training offered on Laparoscopic simulator



Exploring Synthetic Cadaver - Syndaver



Bio motion capture and ergonomic assessment system

Admissions to BS in Medical Sciences & Engineering

Admissions will be through the IISER Aptitude Test (IAT) and in the first BS batch for the limited 30 seats, 20 students were of less than 100 rank in their IAT.

1. MS Program

Master of Science (MS) is a research-based degree. Therefore, the thesis will not be as rigorous as the doctoral program. students in the middle of their MS program can upgrade to a PhD program.

2. PhD Program

The PhD programme for doctors will enable clinicians to delve deep into a problem area of their interest, either independently or in tandem with an engineer from the Department.

3. Joint MD- PhD program with SRIHER

Successful academic collaboration with MD from SRIHER and PhD from DMST, IITM. First batch of students is expected to join soon.



23' First Batch Students at DMST



MoU exchange between SRIHER and IITM

DMST: Students intake as on 01/07/24

S.No	Program	No. of Students Enrolled	
		Ist Yr (23'-24')	IInd Yr (24'-25')
01	Ph.D	09	02
02	MS	-	01
03	BS	29	Admission in progress

Department Faculty

Core Faculty	<ul style="list-style-type: none"> • Prof. Bobby George, Head of the Department • Prof. R Krishna Kumar • Prof. Srikanth Vedantam • Prof. Srinivasa Chakravarthy • Dr. Anubama Rajan • Dr. Pradeeba Sridar
Professors of Practice	<ul style="list-style-type: none"> • Dr. K.R. Balakrishnan • Dr. Vijit Cherian • Dr. Karthik Kailash • Dr. Ajit S. Mullassari • Dr. JSN Murthy • Dr. Bhagyam Raghavan • Dr. Rajiv Raman • Dr. Rajan Ravichandran • Dr. Suresh Seshadri • Dr. S. Vijayakumar
Adjunct Faculty	<ul style="list-style-type: none"> • Dr. M. Srinivas • Dr. R.M. Anjana • Dr. Rita Christopher

Action Plan

Immediate – Short Term

- MoU revision with inclusion of discussed points - IITM & AIIMS
- Suggestions to BS syllabus of MST - AIIMS
- Identifying & sharing SPOC details with fixed timelines on Plan of action - AIIMS

Medium Term

- Bridge course offering - IITM
- One day symposium - IITM & AIIMS
- Summer Internship and facility/faculty/students exchange plan-- IITM & AIIMS.

Long Term (AIIMS & IITM)

- Phased Implementation of all the MoU discussed points.
- Journal publication
- Collaborative research and product startup through center for innovation.
- To jointly achieve the goal of CoE in AI for healthcare.
- MS/ MD/ Phd program-joint offering and collaboration.

Plan Ahead

- Faculty recruitment - focus on attracting top quality faculty
- BS, MS, PhD scholars - Second batch induction, quality postdocs deployment
- Setting up of Research labs
- Activities related to the visibility of the department and research to the right forums and community.
- Ensuring top quality education for the BS students and steps to ensure their future (Internships, Industry Placements).
- Inculcating the entrepreneurship culture and supporting the students and scholars with bright ideas on translating ideas to implementable action item in the field of medical science and Technology.



Endowment Fund

The interest accrued from this endowment is supported to the below causes:

- Techkids
- Ambedkar Jayanthi Celebration
- AM-I-Challenge Institute Day Award
- Monkey proofing work at Quark building
- NASA May day Celebration
- Student Travel Grant
- Arrival kit for Freshers
- Monkey proof waste bin
- Research and Education

02



Ambedkar Jayanthi Celebration

Monkey Proofing work at Quark building

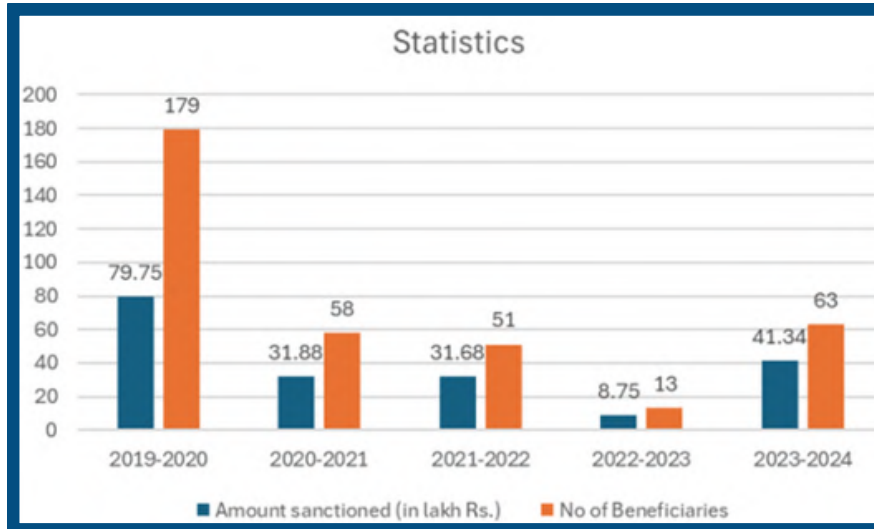


Monkey proof waste bin

NASA May day Celebration

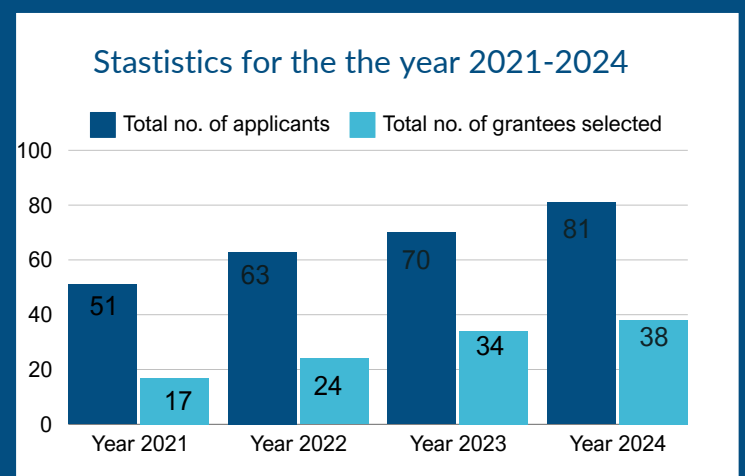


Student Travel Grant



The goal of this travel grant is to facilitate the professional development of undergraduate and graduate students/research scholars and faculty by supporting their travel for attending professional meetings. This also supports exchange programs, summer schools, and joint doctoral programs which provide an opportunity for the recipient to present his/her own research.

Women Leading IITM



The goals of the 'Women Leading IITM' program are: Increasing the percentage of women faculty in Assistant Professorships to 20% from the current 15%; Generating 30% of all faculty applications from Women candidates; Grantees expected to graduate to leadership roles within IITM; Next-generation ambassadors for enabling a gender balanced IITM; Establish an award for Women Faculty in Leadership (Institute already has awards for staff in leadership and given the good presence of women in staff, many have been getting it over the years); Education is an important factor in empowering women. If women's empowerment in the true sense is ever to be realized, it could be only through education. Education brings prosperity not only to the woman and her family but also to the nation.

We are grateful to you!

Shri Lakshmi Narayanan and Smt. Lakshmi



Thank you for your sustained generosity to IIT Madras over the years. Contributors such as yourself enable our students and Professors to dream big and work towards a better and brighter future. We hope you are proud of your alma mater and how it has remained steadfastly committed to academic and research excellence during and after your time here. You and your family have been instrumental in facilitating this significant growth.

Our efforts to nurture the culture of academic excellence that is the hallmark of IIT Madras - quality education, cutting-edge research, and unfettered creativity - shall continue. We are privileged and humbled to have you and your family walking with us along this trail. We wish you and your family the best always in all walks of life!



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