

New maritime course to boost Sagarmala project, avenues along Gujarat coastline

IIT Gandhinagar maiden MTech programme in Maritime Engineering to help build specialised workforce

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With India pushing to modernise ports and strengthen maritime transport under the Sagarmala Project, there is a growing need to create specialised talent in the maritime sector. The launch of MTech in Maritime Engineering programme by IIT Gandhinagar recently, is a step towards building a skilled workforce capable of supporting the country's maritime ambitions.

There is a demand for engineers who can design, manage, and improve maritime systems, from ports and shipbuilding to coastal protection and logistics. Developing this expertise will help reduce logistics costs, boost trade, and support emerging areas like port shipping and the blue economy. Highlighting the need for such a programme, Prof Srinivasan Chandrasekaran, HoD, Maritime Engineering, IIT Gandhinagar, says, "Gujarat has the longest coastline in India with a huge demand in the maritime sector. Building world-class ports requires engineers who understand the entire maritime ecosystem rather than isolated components. If India wants to develop world-class ports and mari-

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time infrastructure, it also needs engineers who understand the entire ecosystem, from ships and cargo movement to port design and coastal systems."

Maritime Engineering as a discipline goes beyond existing fields such as ocean engineering, naval architecture, and marine engineering which are currently offered by select IITs. Prof Chandrasekaran says, "Unlike these specialised domains, maritime engineering covers a broader spectrum, including port and harbour design, coastal systems, shipbuilding, maritime logistics, renewable energy, and coastal protection infrastructure."

AI Integration

The maritime industry is undergoing a significant transformation driven by technology, digitalisation, and regulations, requiring a skilled workforce equipped with a diverse set of technical and soft skills. Focused on the core engineering back-

ground, the MTech programme is interdisciplinary. The programme will be open to graduates from multiple engineering disciplines, including civil, mechanical, and electrical engineering. The course includes sea-board training, hands-on laboratories and field visits to ports, harbours and shipyards. The curriculum will also incorporate emerging technologies such as AI to improve maritime safety and efficiency. Prof Chandrasekaran says, "AI-driven systems can help stabilise vessels during GPS failures caused by extreme weather conditions, reducing risks such as capsizing and cargo loss."

No other institution in India currently offers a dedicated MTech or PhD programme in Maritime Engineering. Prof Chandrasekaran says, "Only a handful of universities in the US, the UK, and parts of Europe offer comparable courses; in Asia too, no university offers this programme so far. This positions India to take a leadership role in the region by developing indigenous ex-

pertise in maritime systems and infrastructure."

Global Collaborations

To strengthen the programme's global outlook, IIT Gandhinagar has already established academic collaborations with institutions such as University of Naples Federico II, Changwon National University, and Kasetsart University. "These partnerships include student and faculty exchange programmes, visiting professors, and joint academic initiatives. The Institute had also conducted an international workshop last year to build momentum for the programme," says Prof Chandrasekaran, adding faculty from across IITs will also be teaching the students.

The course will be open to both Indian and international students and will allow admissions without a GATE qualification. The sanctioned intake for the MTech programme is 15 seats, with an additional 10 seats sponsored by industry, taking the total capacity to 25 students. Industry participation forms a core component of the programme. Organisations such as the Indian Coast Guard, Mazagon Dock Shipbuilders Limited, and port authorities, including Cochin Port Authority and Chennai

Port Authority are supporting the initiative through curriculum inputs and sponsorships. Industry representatives will also be part of the academic board, ensuring that the curriculum remains aligned with real-world requirements and employment needs.

The programme is industry-driven rather than purely academic, with research and training focused on solving practical challenges in maritime logistics, port operations, and infrastructure development. Graduates are expected to find roles across port management, shipbuilding, logistics, and coastal infrastructure sectors.

Addressing existing gaps in maritime education, Prof Chandrasekaran says, "This sector in India is currently dominated by training-based approaches rather than formal academic programmes. There is no structured education addressing advanced areas such as green shipping, blue economy, and integrated port logistics. This programme aims to fill that gap."

While there is currently no undergraduate programme in maritime engineering in India, Prof Chandrasekaran says that such courses may soon be introduced in institutions, including Gati Shakti Vishwavidyalaya. Looking ahead, IIT Gandhinagar plans to scale up the programme based on industry demand and placement outcomes. "As awareness and demand grow, the intake will be increased. Industry-sponsored and international seats will also expand accordingly," he adds.

Rising demand for expert risk assessors moves toxicology from obscurity to opportunity

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Long considered a niche discipline, toxicology — the study involving the impact of chemical substances on living systems in the academic and industrial landscape — has gained significant traction over the last two decades as a critical pillar of public health, environmental safety, and pharmaceutical innovation. As the sector aligns with increasingly rigorous global regulatory standards, this specialised branch of science is offering students a distinct competitive edge over general biology graduates. By mastering the ability to assess, predict and manage the adverse effects of chemicals, toxicology postgraduates are stepping into high-stakes roles across pharmaceuticals, contract research organisations (CROs), food safety and forensic science laboratories. This shift is not just academic but financial, with demand for expert risk assessors on the rise, the field now offers lucrative career trajectories, with senior-level salaries scaling upwards of Rs 20 lakh per annum.

Speaking to Education Times, Akanksha Singh Kachhawa, assistant professor and programme coordinator for Toxicology, School of Medical Studies, National Forensic Sciences University (NFSU), Gandhinagar, says, "What was once a niche subject has evolved into an interdisciplinary course blending chemistry, biology, medicine, and public health. For decades, toxicology as a subject remained fragmented, with PG programmes offered in a few institutes. Demand has risen significantly over the past two decades, particularly after 2005."

Toxicology is the study of toxicants in the air, water, and human bodies. It quietly works at the intersection of science, health, and safety, helping us understand the potential risks and finding preventive cures. "As we confront rising environ-



With no dedicated UG programmes in India, the field remains confined to a handful of specialised master's courses

Industry Needs

Toxicology graduates are increasingly valued in pharmaceuticals, biotechnology, and consumer products sectors. They also get to work in CROs, where they work as toxicologists, who test new chemicals. Beyond the private sector, there is a growing demand for these specialists in government regulatory agencies and forensic laboratories to monitor environmental hazards, and establish safety protocols.

Most students decide their career trajectory based on their personal interest in the subjects. A foundational concept in toxicology is understanding the quantity of substance of any chemical substance. This means that almost any substance, even water or oxygen, can be harmful if taken in large quantities, while many potentially harmful substances may have less impact on humans and the environment if the quantity is minuscule.

Sector Breakdown

The versatility of the field lies in its diverse specialisations, each addressing a unique facet of safety and science. For instance, environmental toxicology tracks how pollutants migrate through air and soil to accumulate within ecosystems, while regulatory toxicology focuses on setting safe exposure limits that protect the public from harmful substances in food and medicine. At a deeper level, systemic toxicology examines the specific impact of toxins on internal organs such as the liver or brain.

"Beyond the laboratory, the discipline takes on a more investigative role; in forensic toxicology, toxicologists detect poisons or drugs to provide critical legal evidence in criminal investigations. In the medical wing, clinical toxicology remains the primary tool for doctors to diagnose and treat patients suffering from chemical exposure or drug overdoses," says Prof Kachhawa.

Salary prospects in the field reflect its growing industry demand. "Freshers typically earn around Rs 3.5 lakh per annum, while mid-level professionals with 1-3 years of experience can expect between Rs 5.5 lakh and Rs 10.5 lakh per annum. At senior levels, with over eight years of experience, salaries can rise to Rs 15-20 lakh or more annually," says Yeshvandra Verma, head and associate professor, Department of Toxicology, Chaudhary Charan Singh University, Meerut.

