MEEd
ASME Mechanical Engineering Education Summit
INDIA

ASME
SETTING THE STANDARD

ENGINEERING EDUCATION SEMINAR

EMPOWERING NEXT GENERATION ENGINEERS

JANUARY 24, 2024 | ANNA UNIVERSITY, CHENNAI

CONTENTS

EXECUTIVE SUMMARY

The ASME India Engineering Education steering committee in association with Anna University and Tamil Nadu Skill Development Corporation organized a one-day seminar “Empowering the Next Generation Engineers” on January 24, 2024, at Anna University, Chennai.

The event saw 200+ participants that were largely educationalists (chairperson of engineering colleges), academicians (principals of all engineering colleges, HOD/deans of core engineering branches and placement officers of engineering colleges across Tamil Nadu). A recurring theme across presentations and sessions was understanding the emerging and existing engineering roles in the core sectors and the various ways the curriculum can be repurposed to meet the expectations for entry or placement into these roles.

There is a need for platforms and forums to facilitate regular consultation with the industry which will be absorbing the engineers passing out of colleges. It was discussed that another related aspect was giving due importance to soft skills (innovation, creativity, problem-solving and collaboration and teamwork) which have become more relevant in the changing and dynamic industrial environment.

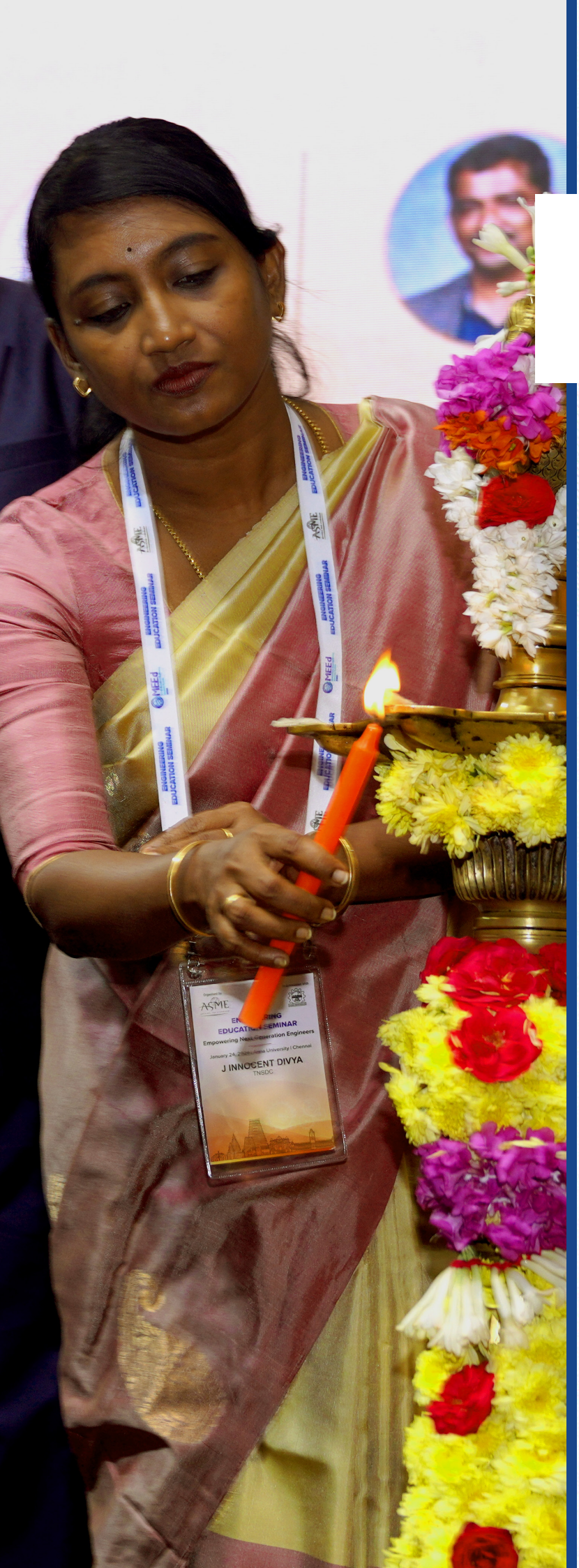
Speakers and panelists persuasively deliberated moving from a predominantly theoretical curriculum to an ideal blend of theory and practical, that is hands-on experiential learning.

To be Industry 4.0-ready, engineers need to be multidisciplinary and in future even transdisciplinary. Three developments necessitate the engineering curriculum reform. They are:

Emergence of new technologies (From Internet of things, cloud computing, predictive analytics, machine learning and Artificial Intelligence) **or the ushering in of Industry 4.0**	**Factor in sustainability** in Design through Manfacturing	Need for adoption of **new business strategies** and practices that **factor in sustainability**

Overall, it was highlighted that the academia-industry interaction should be two-way, osmotic, and mutually nurturing and beneficial.

- High utility internships for students and short-term consultancies for faculty are the way forward. Similarly, industry practitioners should take time off to work in educational institutions.
- The University Grants Commission’s Professor of Practice initiative is a case in point.
- The academia-industry interaction with universities and colleges should go beyond placements and should encompass research and development that results in practical solutions and products which could be patented and commercialized.



Introduction & Overview

The field of engineering is highly dynamic due to the constant emergence of innovation and new technologies. **Industry 4.0 or the fourth Industrial Revolution and sustainability has been occupying the top place in national and global agenda.** There are both daunting challenges and exciting growth possibilities.

As the industry responds to and adjusts to these momentous changes, engineering education too needs to evolve in tandem with the industry. Engineering education should equip students with relevant and updated knowledge and skills so that they can thrive in the industry. The challenge will be to update the curriculum and make it industry-ready.

The above mentioned practices will result in an approach that promises better placements and also stem the declining enrollments in the core engineering disciplines . It will make faculties and thence students more integrative and experiential in their learning approach.

About ASME Engineering Education and MEEd

ASME Engineering Education provides guidance and advocacy to colleges and universities to enhance the quality, content, and relevance of engineering degree programs. It is an influential forum for academicians, researchers and industry leaders on the education of mechanical engineering.

ASME Mechanical Engineering Education (MEEd) is a premier Summit for leaders in mechanical engineering and mechanical engineering technology education.

- MEEd strives to address the challenges impacting the present and future trajectory of engineering education.
- Powered by ASME, MEEd strives to be a platform for discussion about education policy, implementation and its impact within mechanical engineering education.
- The key components of MEEd are:

1. **Sustained engagement** with **engineering educational institutions regarding** curricular innovation
2. Continued collaboration with industry to **incorporate socially responsible,** ethical and **sustainable practices in engineering.**

ASME India engages UG & PG Engineering Students in Indian Institutions for imparting them professional development and experiential learning through its global multifaceted suite of Engineering problem solving competitions(EFests & EFx), Industry Expert workshops , Industrial visits , research fellowships (E4C fellows). Thousands of engineering students participate. Under careers, ASME awards two major fellowships - namely, Engineering for Change (E4C) Research Fellows and Graduate Teaching Fellows.

Inaugural Session

Thirumathi J Innocent Divya,
IAS, Managing Director,
TNSDC

Prof R Velraj,
Vice Chancellor,
Anna University

Mr Ganesh Mani S,
COO, Ashok Leyland

Dr Ramesh Shankar Pudale,
Senior Program Manager,
Autodesk

Dr Shankar Venugopal,
Vice President,
Mahindra & Mahindra

Prof. K Shanmuga Sundaram,
Director, CUIC & Professor,
Engineering Design Division

Mr Madhukar Sharma,
President and Director,
AIPL

The Context and the Challenges

The session emphasized and reiterated the much-felt need to reform the engineering curriculum and make it more practical and skill-oriented. It was also highlighted that the need to promote research also has the potential to be converted into hardware products. Over the last two decades, engineering curriculum has evolved to incorporate industry requirements, but certainly more concrete and strategic efforts need to be done. The future engineers should have the competency, and the right attitude based on the mindsets and continuous learning and updating technology knowledge and skills.

- Academia should strike a fine balance between hands-on practical skills training and innovation and the required theoretical knowledge of core engineering principles.
- The research focus and outcome should be on translating theory into tangible solutions relevant to real world industry.
- Companies want a new breed of engineers to work on cost-effective product and solutions development that are tailored to meet India's requirements and realities.
- The automotive industry wants engineering students to be "mavericks", young professionals who have an exposure to the new emerging technologies and are keen to use them to solve problems. This would require a multidisciplinary approach - knowledge of electrical, electronic, chemical and metallurgical and other allied systems and processes. Like other industries, the automotive industry has

been making concerted efforts to make their technologies and products environment-friendly and sustainable.

- The engineer of the future will be a multifaceted individual who will leverage cutting-edge technologies such as AI to make Industry 4.0-ready systems and processes that work efficiently and will also ensure that they follow sustainable design and practices.
- While updating the curriculum, universities should encourage students to propose result-oriented, practical projects that solve the real world problems of the industry.
- Due importance should be given to soft skills and transferable skills relating to teamwork and collaboration.
- Faculty members should get industry exposure and industry practitioners should take time out for teaching students. The former bring the real-world practices and skills into the classrooms.
- The industry is looking for competency in the recruits and he defined competency as application of skills to solving real world problems. The four mindsets that need to be shaped and nurtured in educational institutions are:

DESIGN THINKING | **EXPONENTIAL THINKING** | **SUSTAINABLE AND SYSTEMS THINKING** | **INNOVATIVE THINKING**

This was the time for call for action in concrete areas relating to the transformation of engineering education - firstly, increasing the practical component, the project-based experiential learning in curriculum which should be followed by an increase in the duration and quality of internships. Secondly, the need to harmonize technology with nature in a sustainable way. Anna University has been actively engaging with the industry and had invited senior professionals to review the curriculum and suggest changes, especially what could be added to make it more up to date.

The inaugural session was followed by two thought-provoking panel discussions and interactive discussions with participants, two industry-specific presentations relating to aerospace and defense and one Presentation by ASME India on its “Sustainability promotion Initiatives and future of engineering education.”

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Panel Discussion - 1

Panelist

Dr N K Ranganath,
Director, Cognizant Solutions

Mr Bharat Pathak,
Head-Sustainable Solutions, Thermax Global

Dr Ramesh Shankar Pudale,
Senior Program Manager, Autodesk

Mr Sathya Prasad Mangalaramanan,
Former Senior VP, Ashok Leyland

Dr Sivakumar Ramalingam,
GM, WABCO ZF

Moderated By

Mr Ranjit Kovilinkal, MD,
Hygeia e-Services Pvt. Ltd.

Reinventing the Real Potential of India's Manufacturing Sector:

The New Growth Formula

The first panel discussion focused on unveiling and highlighting the growth potential of the manufacturing sector and how it is being realized. Here are some points that were discussed:

- To produce highly skilled engineers, educational systems need to collaborate with industry. In this context, reference was made to the collaboration between Confederation of Indian Industry (CII), an apex industry organization, and Anna University in the following areas:

Curriculum Change and Development

Research

Development of Products and its Commercialization

Entrepreneurship

- It was suggested that engineering colleges could study the CII-Anna University MoU and see how it can be replicated and utilized in their respective institutions.

Are engineering colleges and universities teaching students about sustainability and the latest developments in this domain?

- The education system should adopt flexible and holistic frameworks that help students identify and build on their individual strengths.

- The corporates wanting to hire engineers should not give undue importance to grades and instead evaluate the student as a whole - not only his knowledge and skills but also his soft skills, work ethic and overall attitude towards green living and their aspiration to be a part of the industry growth and nation building.
- It is for the academia to align engineering education and curriculum to the new developments in the domain of sustainable technologies and strategies.
- The industry will be transitioning from sweat equity to knowledge equity and similarly move from low margin high volume to high margin low volume paradigm and the academia should adapt to these new developments.
- The academia needs to keep pace with EV and other technologies that the industry is adopting.
- There is a strong need for upskilling, reskilling, and continuous learning to make mechanical engineers multidisciplinary engineers, equipped with knowledge of electrical, electronics and mechatronics which is critical for EV migration.
- How industry and academia can build and leverage a large pool of designers with technology competence and awareness of local conditions is the question. Use of AI and algorithms provide wider, cost-effective options while insights from predictive analytics helps in taking the right design decisions.

Industry Snapshot: Aerospace and Defense

- **Sustainability is a key theme in the aerospace industry** in which 95% of the product is recyclable. The industry is also focused on network operational efficiency to reduce fuel burn, besides the use of sustainable air fuel and renewable and decarbonized energy to reduce the industry's carbon footprint.
- **Engineering curriculum should have, besides basic STEM knowledge, elements such as human intelligence** (especially emotional intelligence and non-linear problem-solving skills) and digital intelligence (predictive analytics, generative AI, etc.). The industry needs such engineers who are proficient in domain knowledge as well.
- **Engineering institution should have a broader outlook** towards linking with industry which should go beyond the traditional interaction that is limited to placements.
- **Regarding academia-industry collaboration,** there is a good example in RDO's initiative titled "Contract for Acquisition of Research Services" (CARS) which many educational institutions, including Anna University, have availed of. Through CARS, DRDO taps into the expertise available in educational institutions.
- **Another notable initiative is the DRDO Industry Academia Centres of Excellence (DIA-CoEs),** under which research would be done in developing the cutting-edge defense technologies through collaboration between students and research fellow, niche technology industry practitioners and DRDO scientists.

Panel Discussion - 2

Panelist

Mr Ganesh Sankaralingam,
Delivery Head-Technology,
Latent view

Ms Kavitha Kalaiselvi,
Director, Talentegrity

Dr Atul Singhal,
Engineering Leader,
Trane Technologies

Ms Ambika Natarajan,
Senior VP,
HCL Technologies

Mr B Suresh,
Ex CPO, Mindtree

Mr E Suresh,
Senior Manager,
Manufacturing, Ashok Leyland

Moderated By

Dr U Chandrashekhar,
CEO, GMSIR

Emerging and Changing Job Roles & Their Proficiencies at Entry-level Opportunity, Expectation & Way Forward

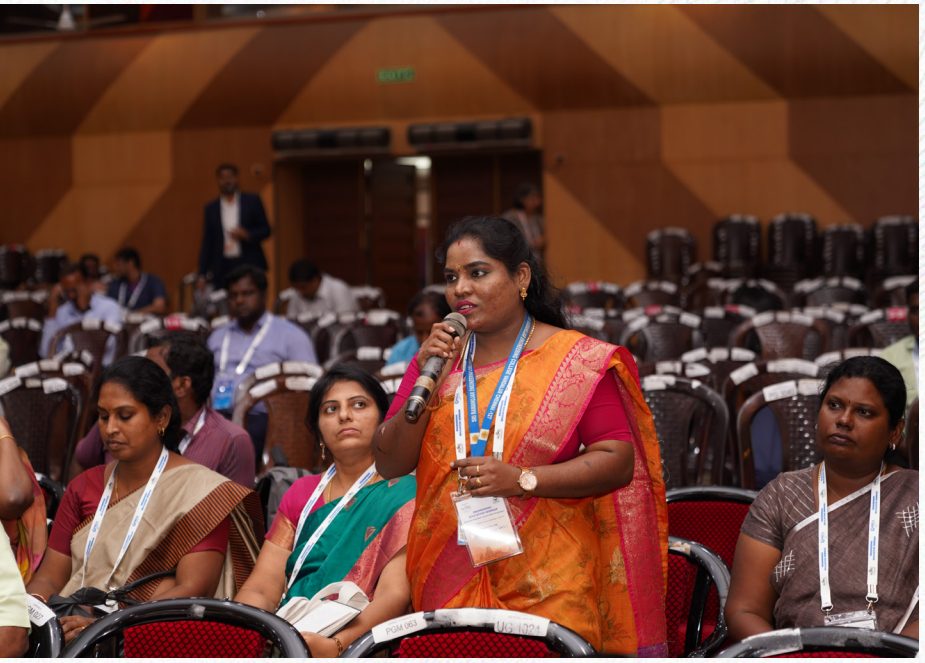
The panelists discussed several issues that are relevant to the faculty members and placement officers.

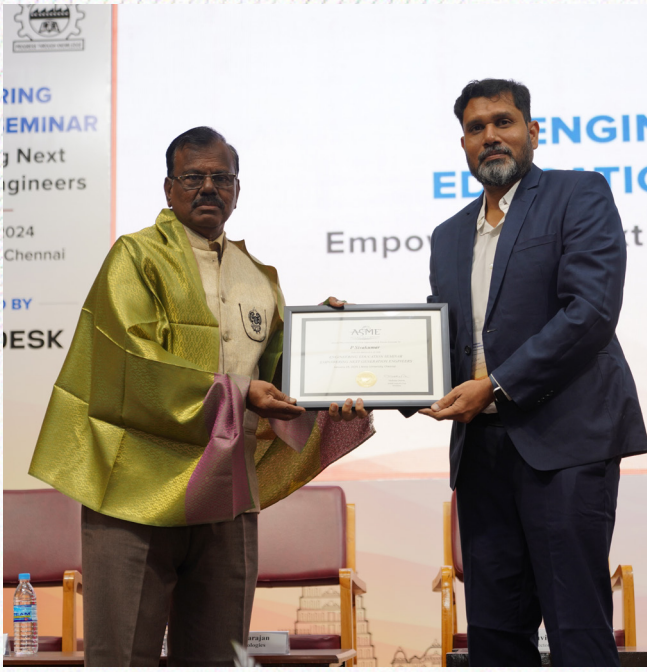
- **Campus placements and employability are interdependent** and much depends on access to opportunities, job-readiness among students and the selection process. When it comes to skills, there is a need to initiate upskilling and combining digital skills with core engineering skills. The undue emphasis on GPA and grades needs to change as companies are keen to have students who have practical skills, soft skills, and digital skills.

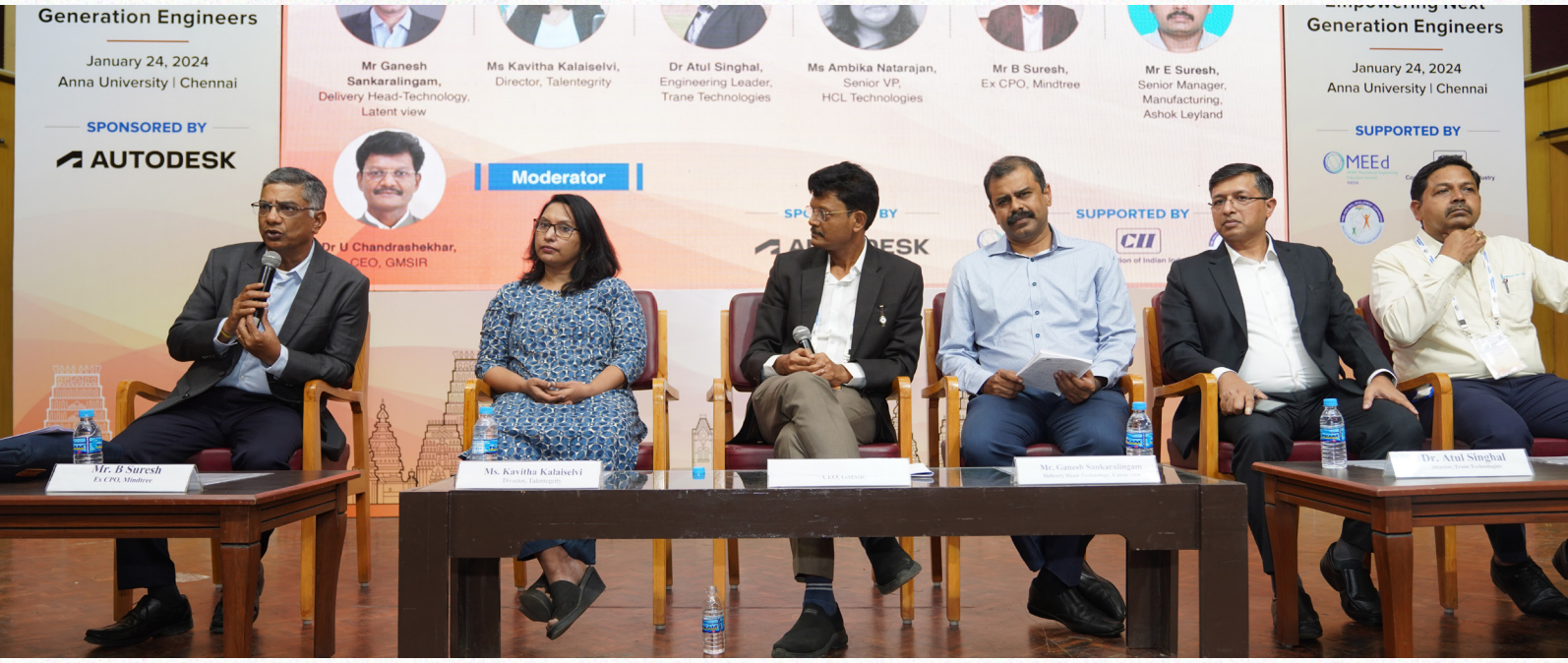
- **One of the major concerns of educational institutions and industry alike is the recent declining trend in IT recruitment** from engineering colleges. It was pointed out that the decline is a temporary phenomenon as IT budgets and discretionary spending by the industry is going to bounce back soon. Besides the IT sector and large corporates solely during campus placements, engineering colleges should focus on emerging start-ups and the growing MSME sector too.

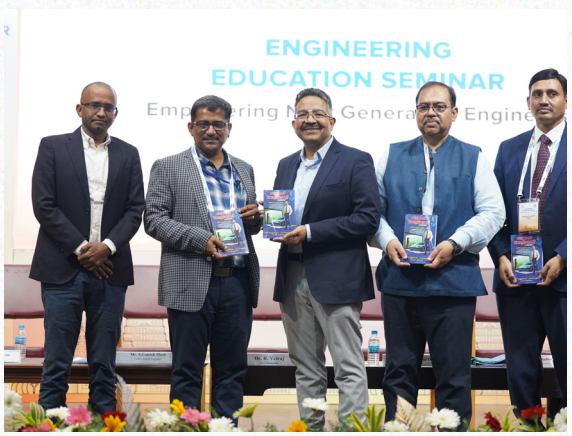
- **Regarding entrepreneurship complementing traditional jobs in the industry,** it was suggested that engineering colleges should have a strong module on entrepreneurship and encourage students to come up with practical business/ technology ideas and then provide them channels to access funds to translate their ideas into start-ups. States like Tamil Nadu have a good start-up ecosystem and engineering colleges are starting incubation centres.

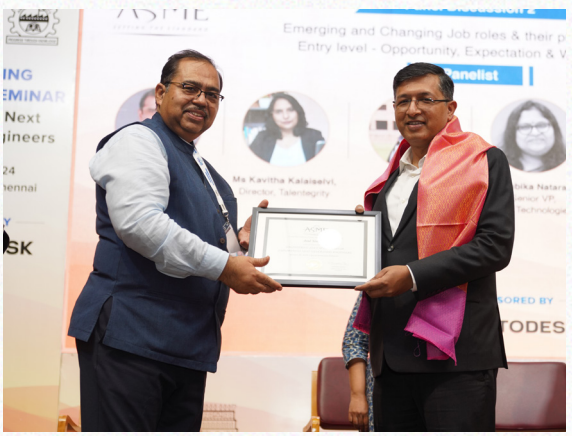
- To boost placements, the engineering colleges should tap into their illustrious alumni network who are in decision-making positions. The alumni who are in the industry could share the latest technologies being implemented in their organizations and how students can acquire these skills through online courses.

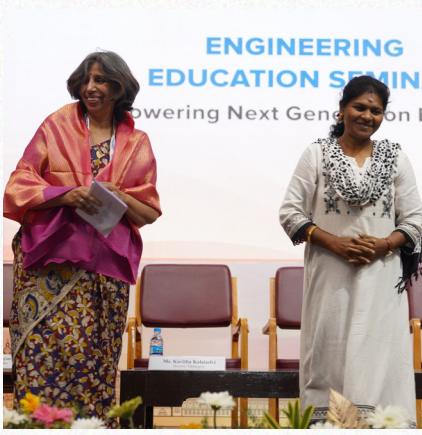












Conclusion

Engineering educational institutions are acutely aware of the need for changing the curriculum to meet the changing expectations of various engineering roles due to rapid changes and advancements in technology and industry practices to adapt to them.

While retaining the emphasis on imparting the foundational knowledge relating to the core engineering subjects, the core engineering disciplines should make space for integrating digital & IT topics and soft skills related to development of communication skills, collaborative skills and project-oriented pedagogy for multi-disciplinary approach in engineering problem-solving.

For implementing the above, there is a greater need for setting-up and convene frequent industry-academia interactions and taskforces involving industry associations and professional development organizations with the help of universities and skill development corporations.

The role of the such taskforce would be to carve out a time-bound roadmap to develop a framework of integration and provide an oversight and guidance for its implementation.

Sub section - The University

- On top of the agenda would be periodic **updating of the curriculum** with inputs from the industry and tweaking the methods of assessment
- **Knowledge domains to be included in curriculum** are sustainability thinking and solutions, Industry 4.0 technologies including AI/ML and IoT.
- **Facilitate industry exposure to the faculty** so that they can incorporate insights into their teaching.
- **Invite industry professionals and practitioners to deliver lectures, conduct workshops and do courses**. The government and educational bodies such as UGC and AICTE have not only given recognition to “Professors of Practice” but also framed rules and guidelines to operationalize it.
- **The placement officers should diversify their portfolio** by including emerging start-ups and the growing MSME sector

The Student Cohort

- Acquire a blend of foundational, theoretical knowledge and practical, hands-on skills
- Take practical projects and internships seriously to apply skills learned in the college
- Besides the skills learned in the college, students belonging to the digitally savvy generation should be open to upskilling and enroll in online courses to acquire new digital/IT skills
- Employment in the industry need not be the only option; students with a flair for entrepreneurship should try their hand in setting up start-ups.

The Industry

- **Actively collaborate with the academia** in the areas of curriculum development and R&D.
- **Play a proactive collaborative role** in the setting up and running of research centres in universities.
- **Help the academia in the area of product development –** in converting multi-disciplinary and trans-disciplinary research ideas into tangible, industry-relevant products and their commercialization
- **Share with academia and educational institutions regarding investment and expansion plans,** introduction of new technologies in manufacturing units, and other information relevant to the practical component of the curriculum

The seminar was not only informative but also provided a platform for constructive dialogue on academia-industry collaboration.

Opportunities for the future