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## **Workshop on “Systems Engineering”**

The workshop on **Systems Engineering** was conducted on 26th March 2026 from 10:45 AM to 1:45 PM at Seminar Hall 2, MVJ College of Engineering. The objective of the workshop was to provide students and faculty members with a deeper understanding of system-level thinking and its real-world applications.

The session was delivered by eminent experts, **Dr. Sudhakar K**, Retired Professor from the Aerospace Department of IIT Bombay, and **Padma Bhushan Dr. B. N. Suresh**, Chancellor and Founder Director of IIST Trivandrum and Chairman of the Board of Governors, MVJCE.

### **Objectives of the Workshop:**

The objective of this workshop is to provide a clear understanding of Systems Engineering principles and their application in developing complex systems also creating awareness about common pitfalls that can lead to system or mission failure. Ultimately, it seeks to equip participants with the knowledge to plan, design, and manage engineering systems in a systematic, reliable, and efficient manner.

**Dr. Sudhakar K** began the seminar by explaining the fundamental concepts of systems engineering and clearly distinguishing it from design thinking. He emphasized that design thinking is more closely related to business and product development, focusing on understanding customer needs, innovation, and market-oriented solutions through stages such as empathy, defining the problem, ideation, prototyping, and testing. In contrast, he explained that systems engineering is an interdisciplinary approach, involving multiple domains are concerned with the structured development, integration, and management of complex systems. He highlighted that while design thinking helps in generating creative ideas and identifying user needs, systems engineering ensures that these ideas are practically implemented in a reliable, efficient, and scalable manner by coordinating various subsystems and meeting constraints such as cost, performance, and schedule.



**Dr. Sudhakar K, Retired Professor, Aerospace Department, IIT Bombay, and Dr. B. N. Suresh, Chancellor and Founder Director of IIST Trivandrum, with participants at the event.**

He further discussed the importance of systems engineering in handling complex systems and explained common reasons for system failures, including inadequate understanding of requirements, lack of coordination between subsystems, insufficient risk assessment, poor estimation of resources, frequent design changes, and ineffective management practices, along with the issue of poorly defined software testing.



**Dr. Sudhakar K, Retired Professor, Aerospace Department, IIT Bombay, addressing the audience on systems thinking.**

**Dr. B. N. Suresh**, Chancellor and Founder Director of IIST Trivandrum, continued the session by explaining the application of systems engineering in aerospace and complex missions, emphasizing that such systems are multidisciplinary and involve multiple agencies, requiring clear requirements, defined operating environments, and strong coordination among subsystems. He elaborated on the systems engineering lifecycle, including requirement analysis, conceptual design, system integration, testing, verification, and validation, and explained the V-model which ensures that every stage of design is matched with corresponding testing activities. He also highlighted the importance of risk assessment and management, the responsibilities of systems engineers in stakeholder interaction, system analysis, integration, and communication, and the need for regular design reviews to ensure successful project execution. Using real-world examples such as flyover construction, he demonstrated how lack of proper systems engineering can lead to delays, inefficiencies, and coordination issues.



**Dr. B. N. Suresh addressing the audience on systems engineering principles.**

**Dr. B. N. Suresh** emphasized that System Engineering Essentials focuses on a structured approach to developing successful systems by ensuring that all stages—from concept to operation—are carefully planned and executed. It involves identifying system goals, defining the mission, and systematically capturing and analyzing requirements to understand the desired outcomes. Engineers explore multiple design alternatives, evaluate trade-offs, and select the most robust and efficient solution while considering constraints and potential risks. The process further includes rigorous testing, verification, and validation to ensure that the

system is built correctly and performs effectively in real-world conditions. As emphasized by **Dr. B. N. Suresh**, systems engineering is not just a technical activity but a disciplined and holistic approach that integrates planning, analysis, and continuous evaluation to achieve reliable and mission-oriented outcomes.

**Dr. B. N. Suresh** further explained the System Engineering Cycle using the V-diagram, emphasizing the importance of a systematic flow from defining requirements to integration and testing. He highlighted that the left side of the V focuses on “defining what to build,” including system requirements, subsystem design, and detailed specifications, while the right side focuses on “integrating and testing what has been built” through various levels of verification and validation. He also stressed the critical role of reviews at every stage of the system lifecycle, such as Preliminary Design Review (PDR), Critical Design Review (CDR), and System Readiness Review (SRR). According to him, continuous and rigorous reviews help in early identification of issues, better understanding of system interactions, and effective tracking of objectives, ultimately ensuring timely and successful system development.



#### **The Chief Guest interacting with participants and addressing their questions.**

Dr. B. N. Suresh concluded with a powerful insight that **neglecting Systems Engineering is almost a sure prescription for mission failure**. He pointed out that insufficient effort in understanding requirements can lead to incorrect system development, while neglecting the concept of operations may result in systems that fail in real-world conditions. Ignoring interactions and interdependencies among subsystems can cause unexpected breakdowns, and the absence of proper risk assessment and planning can allow problems to arise unpredictably. He further highlighted that inaccurate initial estimates of complexity, resources, and timelines often lead to delays and inefficiencies. Frequent changes in the system create instability and rework, while poor assessment of technological challenges can make implementation difficult. Additionally, jumping to conclusions without proper analysis can result in wrong decisions, and ineffective system management practices can ultimately jeopardize the entire project. Thus, a disciplined and structured systems engineering approach is essential for achieving successful and reliable outcomes.

#### **Conclusion of the Workshop:**

Overall, the workshop provided valuable insights into the importance of systems engineering as an interdisciplinary discipline essential for the successful execution of complex engineering projects.