



# PRODUCT ENGINEERING AND DESIGN THINKING

## PROF. PRANAB K DAN

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**PRE-REQUISITES :** After 1st year of UG Technology/Engineering (B.Tech/B.E./B.Des.)

**INTENDED AUDIENCE :** UG/PG/Research Scholar/Faculty

**INDUSTRY SUPPORT :** Industry in the Engineering and Manufacturing sectors covering automotive, white goods producers, equipment manufacturers, consumer goods manufacturing sectors, mechatronic manufacturers, assistive technology-based product developers and devices in health care sectors, prototype development servicing centers etc

### COURSE OUTLINE :

The approach in Product Engineering begins with the conceptualization and design of the product that determines the course of Innovation and Development and, hence, emphasis is placed here and will be covered through the topics such as, Product Design Specification and Planning; Integrating the Fuzzy Front End of complex product development; Concept Generation, evaluation, selection and testing methods; Embodiment design, product architecture, configuration design, and ecodesigning; Design for Manufacturing and prototyping engineering; Product Innovation in Design Thinking Paradigm with affordability engineering complying quality, robustness and reliability with illustrations; Design challenge themes in complex product development, such as mechatronic devices; Design Thinking steps, tools and methodologies; Design Entrepreneurship and user experience study methods in Industrial Design. The above content will provide comprehensive input to engineering students anchored on mechanical technology that will build the competence of new age professionals to handle the challenges of solution development as needed for the emerging economy and society, alongside as adapted in blue-chip industries and reflecting the same in the curricula of world-class Universities

### ABOUT INSTRUCTOR :

Prof. Pranab K. Dan, Associate Professor at the Indian Institute of Technology Kharagpur, in the School of Engineering Entrepreneurship (RMSoEE), obtained his bachelor's and master's degrees in Mechanical Engineering from IEST, Shibpur, and Ph.D. in Production Engineering from Jadavpur University. He has been the Founding-Head of the Industrial Engineering & Management Department at the West Bengal University of Technology. Before joining academics, he worked in several renowned national and multinational industrial organizations, such as GEC-Alstom Ltd., Williamson & Magor Group company, and held senior positions, bringing industrial perspectives. His research interests encompass Design Thinking and Innovation, Automotive Powertrain Engineering and Ecodesigning, Product Engineering and Innovation in Process in Product Development and value-sensitive Frugal Engineering. He has introduced courses like 'Engineering Design Process', Frugal Engineering and 'Design Thinking Lab' at IIT Kharagpur and also teaches Technology Entrepreneurship, focused on design-led product creation. He has authored more than 70 peer-reviewed journal and conference articles and book chapters. He has supervised several Ph.D.'s and is guiding several others. His research group in the 'Product Analytic and Modeling Laboratory (PAM Lab)' are engaged in research in Assistive Technology, Engineering Optimisation, and design creativity. He has been on the technical committees of prestigious design and manufacturing-related international conferences and reviewer for journals. He mentored product-based start-ups and is the Chairman of the Entrepreneurship Cell at IIT Kharagpur. Prof. Dan has been the Principal and Co-Principal Investigator of several sponsored projects, including the prestigious 'National Initiative for Design Innovation' sponsored by MHRD, Govt. of India. He has traveled across the country and abroad to deliver talks and presentations on the subject matter. He is a Fellow Member of the Association of Engineers, India.

Prof. Prabir Sarkar is an Associate Professor in the Department of Mechanical Engineering at the Indian Institute of Technology Ropar. He was also the Chairman of the Intellectual Property Rights (IPR) cell of the Institute. Before joining IIT Ropar. He worked as an Associate Researcher at the National Institute of Standards and Technology (NIST), U.S. Department of Commerce Gaithersburg, USA. He completed his Ph.D. in Design Creativity from the Indian Institute of Science (IISc), Bangalore. He also did his Master of Design from IISc on Product Design and Engineering. He worked for Bharat Earth Movers Limited (BEML) in the Research and Development division after completing his master's. Prof. Sarkar's research interests include product design, sustainability, creativity, and design research. He is interested in developing new methods and tools for helping designers and companies to design novel, useful, and sustainable products. He has authored more than 80 peer-reviewed journal and conference publications. His research group in the Design Research Laboratory and Sustainable Design and Manufacturing Laboratory are engaged in research in Ecodesign, biomimicry, engineering aesthetics, sustainable machining, and design creativity. He is an editorial board member of Journal of Engineering, Design and Technology, Emerald and is a reviewer of several journals and conferences. Dr. Sarkar secured jointly funding of more than 100 crores from various external funding agencies. He is currently a fellow of the Institute of Engineers, India.

**COURSE PLAN :**

**Week 1:** Introduction to Product design, product engineering, and design thinking; Product Design Specification and Planning

**Week 2:** Integrating the Fuzzy Front End of complex product development aligned to Design Thinking Models

**Week 3:** Design Thinking for need identification and product specification; Conceptual design stemmed from Idea generation, tools, and techniques

**Week 4:** Concept Generation, evaluation, selection, and testing methods

**Week 5:** Embodiment design, product architecture, configuration design; Eco-design

**Week 6:** Design for Manufacturing and Prototyping Engineering (Digital and Rapid); Product Innovation in Design Thinking Paradigm with affordability engineering complying with quality, robustness, and reliability with illustrations

**Week 7:** Design challenge themes in complex value-sensitive product development, such as mechatronic devices; Design Thinking steps, tools, and methodologies; Application of Design Thinking in product engineering and Frugal Innovation

**Week 8:** Design Entrepreneurship and user experience study methods in Industrial Design.