**OVERVIEW**

Are you involved in designing mechanical mechanisms, systems or products? Do you want to catalyze a culture of innovation in your organization?

This course will take you through the fundamentals of developing innovating precision machines using the deterministic design process and philosophy, which fosters creativity and focuses on applying physics-based principles while minimizing risk. Classroom lectures, hands-on lab exercises and case studies will focus on how to achieve robust, high quality designs that efficiently balance precision and cost. Whether you focus on subsystems or are responsible for complete products, this course has something for you and attendees are encouraged to share their own design challenges.

Precision is found in all types of machines, whether the desired accuracy is in nanometers or millimeters, and this course will teach you how to consider performance requirements, the effects of manufacturing variances, and potential failure modes during the engineering design stage, so as to ensure reliable operation, while meeting performance and cost targets. Specific machine element topics will include: linkages, screws and gears, actuators, structures, joints, and bearings. Error apportionment, tolerancing, and budgeting methods are presented to illustrate how machine elements are combined to produce a system. Each topic is covered with respect to its physics of operation, mechanics (strength, deformation, thermal effects), and accuracy, repeatability, and resolution.

Participation and teamwork are integral to the success of this course. In the spirit of the MIT motto Mens et Manus, you will demonstrate practical application of the theory (mens) through hands-on conceptualization, fabrication and testing (manus) of a small precision system. Participants are encouraged to bring their own design challenges on paper or in a box and, together, we will use the deterministic design process to develop solutions.

We will provide ample networking opportunities and we expect that this course will be FUN!

**TAKEAWAYS**

- A structured deterministic design process
- Translating an opportunity into requirements and specifications
- Applying the fundamentals of advanced mechanical design
- Conducting risk analyses and developing countermeasures
- Strategies for innovating new products

**WHO SHOULD ATTEND**

The ideal participant is a leader who is responsible for designing innovative mechanical hardware. They should be equally willing to go hands-on and get dirty as to enable others to launch their own development efforts. The deterministic design process and FUNdaMENTALS of precision product design are widely-applicable. We are industry-agnostic and welcome participants from fields as varied as consumer products, medical devices, and oil and gas equipment.

Participants often include those with titles such as VP of R&D, Director of Engineering, Manager Global Research, New Product Development Manager, Director of Corporate Innovation, and Design Engineer as well as their direct reports.

Participants should have a bachelor's or higher degree in engineering or substantial experience with making and must be comfortable working in a hands-on environment.

**COMPUTER REQUIREMENTS**

Laptops with Excel are required for this course and it is suggested that you have a CAD program installed. Participants should wear clothing appropriate for a workshop environment (i.e. closed-toed shoes, hair tied back, higher-necked shirts, no long ties, etc.). Safety glasses will be provided.

Learn more and register at shortprograms.mit.edu/ippd or email shortprograms@mit.edu

**INSTRUCTORS**

**Alexander Slocum** is the Pappalardo Professor of Mechanical Engineering at MIT, a MacVicar Faculty Teaching Fellow, and a Fellow of the ASME. He directs the Precision Engineering Research Group. He has several dozen issued U.S. patents, many foreign patents, and many more pending, many of which are licensed and cover successful products. He has helped develop 12 products that have earned prestigious R&D 100 awards for being “one of 100 best new technical products of the year” as determined by R&D magazine.

**Dr. Nevan Hanumara** is the Program Manager for the MIT Tata Center for Technology + Design and a Research Scientist in MIT Mechanical Engineering’s Precision Engineering Research Group. He focuses on mechanical design and human factors as he works with clinicians to develop medical device solutions to interventional challenges as well as addresses industrial innovation opportunities.