



# MECHANICS OF MACHINING

## PROF. UDAY S. DIXIT

Department of Mechanical Engineering  
IIT Guwahati

**PRE-REQUISITES :** Strength/Mechanics of Material and Materials Science at UG level

**INTENDED AUDIENCE :** UG and PG students of Mechanical/Production/Manufacturing

**INDUSTRIES APPLICABLE TO :** Bharat Heavy Electricals Limited (BHEL), Hindustan Aeronautics Limited (HAL), Defense Research and Development Organization (DRDO), Die manufacturing industries, Automobile Industries, Machine Tool Industries, Precision medical equipment manufacturing industries.

## COURSE OUTLINE :

Machining is a metal removal process, which can be accomplished by applying force on raw material by means of a cutting tool. This course aims at explaining the physics of the cutting process. The course will contain discussion of statics, kinematics and kinetics of the cutting process. Experimental findings relevant to mechanics of the process will also be discussed. The course will also include introductory discussion on non-traditional machining processes.

## ABOUT INSTRUCTOR :

Prof. Uday Shanker Dixit received B.E. degree in Mechanical Engineering from erstwhile University of Roorkee (now Indian Institute of Technology Roorkee) in 1987, M.Tech. degree in Mechanical Engineering from Indian Institute of Technology Kanpur in 1993, and Ph.D. in Mechanical Engineering from IIT Kanpur in 1998. He has worked in two industries— HMT, Pinjore and INDOMAG Steel Technology, New Delhi, where his main responsibility was designing various machines. Dr. Dixit joined the Department of Mechanical Engineering, Indian Institute of Technology Guwahati, in 1998, where he is currently a Professor. He was also the Officiating Director of Central Institute of Technology, Kokrajhar from February 2014 to May 2015. Dr. Dixit is actively engaged in research in various areas of design and manufacturing since last 30 years. Most of his research work is focused on Modelling of Manufacturing Processes and involves finite element analysis of elastoplastic problems. He has authored/co-authored 136 journal papers, 120 conference papers, 40 book chapters and 7 books in mechanical engineering. He has also co-edited 10 books related to manufacturing. He has guest-edited 11 special issues of journals. Presently he is an Associate Editor of the Journal of Institution of Engineers (India), Series C and Regional Editor Asia of International Journal of Mechatronics and Manufacturing Systems. He has guided 15 doctora and 51 masters' students. Dr. Dixit has investigated a number of sponsored projects and developed several courses including a NPTEL course on Engineering Mechanics.

## COURSE PLAN :

**Week 1:** Deformation of metals, Mechanism of plastic deformation, Machining processes: Single edge tool, types of chips

**Week 2:** Tool geometry: single point cutting tool specifications, Tool specifications, conversion of tool angles, Multi-point cutting tools, Mechanics of orthogonal cutting, force relationships

**Week 3:** Determination of stress, strain, and strain rate, measurement of shear angle, other analysis for force relationships

**Week 4:** Mechanics of oblique cutting, Measurement of cutting forces

**Week 5:** Thermal aspects of machining: Temperatures in orthogonal cutting, Tool wear and tool life and tool life equations, Economics in machining

**Week 6:** Practical machining operations: Turning and shaping & planning operation, milling and drilling, Grinding of metals and mechanics of grinding process

**Week 7:** Abrasive machining and finishing operations, CNC machines and CNC programming

**Week 8:** Introduction to advanced machining processes