



# MACHINING SCIENCE

**PROF. SOUNAK KUMAR CHOUDHURY**

Department of Mechanical Engineering  
IIT Kanpur

**TYPE OF COURSE** : Rerun | Elective | PG

**COURSE DURATION** : 4 weeks (24 Jan' 22 - 18 Mar' 22)

**EXAM DATE** : 27 Mar 2022

**PRE-REQUISITES** : Basic Manufacturing Engineering Courses

**INTENDED AUDIENCE** : Mechanical Engineering, Metallurgy, Aerospace Engineering, Production Engineering

**INDUSTRIES APPLICABLE TO** : All Manufacturing industries, Machine tool manufacturing industries, Automobile Industries and aeronautical industries

## **COURSE OUTLINE :**

The course will basically deal with the following topics:

Machining, Machining Process, Tool Geometry, Mechanics of Metal Cutting, Friction in Metal Cutting, Mechanism of Oblique cutting, Practical Machining Operations, Measurement of cutting Forces, Tool Material, Tool Wear and Tool Life, Abrasive Machining Processes, Economics of Machining, Thermal Aspects of Machining, Surface finish.

## **ABOUT INSTRUCTOR :**

Prof. Choudhury completed his Ph.D. in Mechanical Engineering from Moscow, Russia in 1985 followed by post-doctoral at the same university till 1986. From 1986 he has been involved in teaching and research in the Mechanical Engineering Department of Indian Institute of Technology Kanpur. His areas of specialization are conventional and non-conventional machining, automatic control, hydraulic control, machine tools and manufacturing automation.

## **COURSE PLAN :**

- Week 1:** Machining; Plastic Deformation, Tensile Test, Stress and Strain; Mechanism of Plastic Deformation: Slips, defects, plastic deformation on atomic scale; Types of machining processes; Chip formation; Orthogonal and Oblique Cutting; Types of Chips; Built-up edge formation; Tool specification; Tool angle relationships in ORS and ASA and NRS; Selection of Tool Angles; Multiple-point cutting tools: twist drill, helical milling cutter.
- Week 2:** Merchant's Circle Diagram; Co-efficient of Friction: Determination of stress, strain and strain rate; Measurement of shear angle; Thin Zone model: Lee and Shaffer's Relationship; Thick Zone model: Okushima and Hitomi Analysis; Nature of sliding friction; Friction in Metal Cutting: Sticking and Sliding Zones, Determination of mean angle of friction
- Week 3:** Mechanism of Oblique Cutting: Normal Rake angle, velocity rake angle and effective rake angle; shear angles; velocity relationship; Force relationships in oblique cutting; Practical Machining Processes: Turning, shaping and planing, Slab milling, Drilling: Machining Parameters, force magnitudes, power consumption, material removal rate, time per pass.
- Week 4:** Measurement of Cutting Forces: Basic methods of measurement: Axially Loaded members, Cantilever Beam, Rings and Octagon, dynamometer requirements; machine tool dynamometers; Types of tool wear; Mechanisms of wear: Abrasion, Adhesion and Diffusion. Progressive tool wear: flank and crater wear. Tool Life: variables affecting tool life - cutting conditions, tool geometry, Types of tool materials, fabrication of cutting inserts, coatings, work material and cutting fluid; Machinability and their criteria.