

# AMTD11 METAL CUTTING AND TOOL DESIGN

## UNIT-1 METAL MACHINING

- 1.1 Introduction, Mechanics of Metal Cutting, Chip formation.
- 1.2 Shear Zone. Shear Plane angle: Different Theories. Friction in Metal Cutting. Chip Flow Velocity. Shear Strain.

## UNIT-2 MEASUREMENT OF CUTTING FORCES

- 2.1 Dynamometer Requirements. Classification of Cutting Force Dynamometers. Mechanical Type Hydraulic and Pneumatic Type. Optical Type. Inductance Type.
- 2.2 Piezoelectric Type. Strain, Gauge Dynamometers. Lathe Tool Dynamo-meter. Drill Dynamometer, Milling Dynamometer. Grinding Dynamometer.

## UNIT-3 HEAT IN METAL CUTTING

- 3.1 Heat Sources in Metal Cutting. Temperature in Chip Formation. Temperature Distribution.
- 3.2 Factors Effecting the Temperature-Work Material, Cutting Variables, Tool Geometry, Cutting Fluid.

## UNIT-4 FAILURE OF CUTTING TOOLS

- 4.1 Tool Wear and Tool Life; Premature failure. Gradual Wear. Crater Wear. Flank Wear, Grooving Wear, Chip notching,
- 4.2 Wear Mechanisms in Metal Cutting, Abrasive Wear, and Diffusion Wear.
- 4.3 Adhesion, Oxidation Wear. Tool Life, Taylor's Tool Life Equation. Woxen's Equation. Cutting Conditions for Limiting Tool Life Conditions. T-V-he Tool Life Plots.
- 4.4 Cutting Rate- Tool Life Characteristics Curve.

## UNIT-5 TOOL WEAR MEASUREMENT

- 5.1 Optical Methods; Flank Wear, Crater Wear Measurement. Radioactive Methods.
- 5.2 Electron Probe Micro Analyzer-EPMA. Energy\_ Dispersive X-ray Analysis-EDXA. Augur Electron Spectroscopy -AES.

## UNIT-6 TOOL MATERIALS

- 6.1 Requirements of Tool Material. Classification. Tool Steels. H.S.S. Coated H.S.S. Powder Metallurgy H.S.S. Cast Cobalt Alloys-Stellite,
- 6.2 Cemented Carbides; Tungsten Carbide Manufacture of Powder, Blending, Briquetting, Sintering, Hot Isostatic Pressing, Properties.
- 6.3 Multi Carbide Tools; Properties. Coated Carbide tools; Coating Techniques; PVD Process, CVD Process. Performance of coated Tools. Oxicoated Tools. TiN coated Tools. ALON coated Tools.

## UNIT-7 CEMENTED TITANIUM CARBIDE & CERAMIC CUTTING TOOL

- 7.1 Properties, Microstructure Performance, Crater Wear Propagation. Diffusion Wear in CTC tools. .

- 7.2 Mechanisms of Wear in CTC tools. Ledge Formation, TiC coated CTC Tools. Microstructure. Performance.
- 7.3 Ceramic Cutting Tools- Powder Preparation, Sintering. Additives, Properties. Performance. SIALON tools. Cubic Boron Nitride (CBN) tools.

### **UNIT-8 TOOL GEOMETRY**

- 8.1 Tool Nomenclature. Basic Tool Angles, Effect of Basic Angles. Tool Nomenclature Systems; British System,
- 8.2 American Standard Association System, German System, ISO System. Geometrical Relationship of True Rake Angle, Angle of Inclination. Cutting Tool Design General Considerations.

### **UNIT-9 CUTTING FLUIDS**

- 9.1 Functions of Cutting Fluid, Lubrication in Metal Cutting; Cooling Properties of Cutting Fluids.
- 9.2 Types of Cutting Fluids; Petroleum Based, Emulsified, Synthetic Type. Additives, Selection and Application of Cutting Fluids.

### **UNIT-10 ECONOMICS OF MACHINING**

- 10.1 Production Cost. Economic Tool Life. Optimum Cutting Speed for Maximum Production. Tool Life for Maximum Profit.

### **UNIT-11 DESIGN OF DRILL, MILLING, MILLING**

- 11.1 Twist drill construction. Drill diameter- design of milling cutter-types of milling cutters, profile sharpened.-design of broach,
- 11.2 Design elements of broach, cutting tool manufacturing. Thread cutting tools thread cutting dies. Thread rolling tools. Design of thread cutting taps.

### **UNIT-12 GEAR CUTTING TOOLS**

- 12.1 Gear Form Cutting Tools. Gear Generation Cutting Tools. Design of a Gear Cutting Hob. Profile in the Normal Section.
- 12.2 Diameter of the Hob. Hob Length. Relief Angle. Cam Relief. Pitch Cylinder Diameter. Gear Shaper Tools.

### **UNIT-13 DESIGN OF REAMER**

- 13.1 Reamer Design. Length. Flutes. Rake Angle and Relief Angle. Grinding of Reamer.

### **REFERENCE BOOKS:**

1. Metal Cutting and Tool Design, 2/e by B J Ranganath, Vikas Publishing House Books from same Author: B J Ranganath
2. Metal Cutting and Tool Design (English, Paperback, Ashok Kumar Singh).