MEPC3003 METAL CUTTING & MACHINING (3-0-0)

Course Objectives:
This course explores metal cutting principles, tool geometry, and machining processes (conventional and non-traditional). Students will analyze tool wear, cutting forces, and machinability criteria, and apply Taylor's tool life equation. Emphasis is placed on machine tool operations, CNC technology, and advanced processes like EDM, laser machining, and ultrasonic machining.

Module – I: (06 Hours)
Geometry of cutting tools in ASA and ORS, Effect of Geometrical parameters on cutting force and surface finish, Mechanics of chip formation, Merchant's theory, Force relationship and velocity relationship, Cutting tool materials. Types of Tool Wear: Flank wear, Crater wear, Wear measurement, Temperature in metal Cutting, Cutting fluid and its effect.

Module – II: (06 Hours)
Machinability Criteria, Tool life and Taylor's equation, Effect of variables on tool life and surface finish, Measurement of cutting force, Lathe tool dynamometer, and Drill tool dynamometer. Economics of machining: Minimum cost, Maximum production and Maximum profit rate.

Module – III: (06 Hours)
Conventional machining process and machine tools: Turning, Drilling, Shaping, Planning, Milling, Grinding. Machine tools used for these processes, their specifications and various techniques used.

Module – IV: (06 Hours)
Tool holding and job holding methods in different Machine tools, Types of surface generated. Production Machine tools: Capstan and turret lathes, single spindle and multi spindle semiautomatics, CNC Machine tools.

Module – V: (06 Hours)
Non-traditional Machining processes: Ultrasonic Machining, Electro Chemical Machining, EDM, Wire EDM, Abrasive Jet Machining, Plasma Arc Machining and Laser Beam Machining.

Course Outcomes:
CO1: Remembering (Knowledge): Recall tool geometry systems (ASA, ORS), types of tool wear, and fundamentals of chip formation.
CO2: Understanding (Comprehension): Explain the impact of tool geometry, cutting fluids, and variables on tool life and surface finish.
CO3: Applying (Application): Calculate tool life using Taylor's equation and analyze cutting forces using dynamometers.
CO4: Analyzing (Analysis): Compare conventional and non-traditional machining processes (e.g., EDM, laser) based on efficiency, precision, and applications.
CO5: Creating (Synthesis): Design machining strategies for cost-effective production, integrating CNC and advanced processes for complex geometries.

Reference Books

1. A Bhattacharryya, Metal Cutting, Theory and Practice, New Central Book Agency (p) Ltd, 1st Edition, 2022.
2. A B Chattopadhyay, Machining and Machining tool, Wiley Publisher, 2nd. Edition, 2021.
3. Sreeramulu Moinikunta, Production Technology, Volume 2, Wiley Publisher, 1st. Edition 2019.
4. P. K. Mishra, Nonconventional Machining, Narosa Publishing House, 2007.
5. Production Technology HMT, Tata McGraw Hill, 2001.
6. M. C. Shaw, Metal Cutting Principles, Second Edition, Oxford University Press, 2005.