

MFPC3003 NON-TRADITIONAL MACHINING PROCESSES (3-0-0)

Course Objectives:

To equip students with comprehensive knowledge of non-traditional machining (NTM) processes. This includes understanding their principles, mechanisms, equipment, process parameters (and their effects), material removal rates, industrial applications, advantages, limitations, and comparisons for precise material removal where conventional methods fail.

Module - I (08 Hours)

Introduction – Need for non-traditional machining processes – Classification of non-traditional machining processes. Applications, advantages and limitations of non-traditional machining processes.

Ultrasonic Machining (USM): Principle, material removal rate, effect of process parameters on performances, industrial applications, advantages and limitations. Abrasive jet and Abrasive water jet machining: Principle, Material removal rate, effect of process parameters, industrial applications, advantages and limitations.

Module - II (06 Hours)

Electro-chemical machining: Chemical machining, need for electro-chemical machining, principle, process characteristics and effect of parameters, material removal rate, applications, advantages and limitations. Introduction to processes like Electrochemical honing, and Electrochemical grinding.

Module - III (08 Hours)

Electrical discharge machining (EDM): Introduction, mechanism of material removal, equipment details, effect of process parameters, industrial applications, advantages, and limitations. Introduction to Electrical discharge grinding, and Electrochemical discharge machining (ECDM).

Plasma arc machining (PAM): Introduction, transfer and non-transfer type plasma machining, equipment details, mechanism of metal removal, process parameters and effect on process characteristics, applications, advantages and limitations.

Module - IV (08 Hours)

Laser beam machining (LBM): Principle of LASER beam generation, mechanism of metal removal, LBM parameters and characteristics, industrial applications, advantages & limitations.

Electron beam machining (EBM): Introduction, principle, equipment and mechanism of metal removal, applications, advantages and limitations.

Module – V (06 Hours)

Nano finishing processes: Introduction to Abrasive flow machining, Chemo-mechanical polishing, Magnetic abrasive finishing.

Course Outcomes:

- CO1: Define the principles, mechanisms, and equipment of key NTM processes (USM, AJM/AWJM, ECM, EDM, PAM, LBM, EBM) and nano-finishing techniques, explaining their material removal mechanisms. (Covers Modules I-IV, V)
- CO2: Identify appropriate NTM processes for specific material and geometric requirements, considering their fundamental capabilities and constraints. (Covers Modules I-IV)
- CO3: Determine the effect of critical process parameters (e.g., power, pressure, voltage, current, pulse characteristics, abrasive properties) on performance metrics (like Material Removal Rate - MRR) for various NTM processes. (Covers Modules I-IV)
- CO4: Compare and contrast the advantages, limitations, and industrial applications of different NTM processes, assessing their suitability for specific manufacturing scenarios. (Covers Modules I-IV)
- CO5: Analyze the fundamental mechanisms and process characteristics of electrochemical honing, electrochemical grinding, electrical discharge grinding, and electrochemical discharge

machining (ECDM), evaluating their niche applications. (Covers Modules II, III, V - specific sub-processes)

Text Books

1. Modern Machining Process by P.C Pandey and H S Shah. McGraw Hill Education India Pvt. Ltd. 2000.
2. Production technology HMT McGraw Hill Education India Pvt. Ltd 2001.
3. Non-traditional Manufacturing Processes by G.F Benedict. Marcel Dekker Inc., New York 1987.
4. New Technology by Amitabha Bhattacharyya. The Institute of Engineers (India) 2000.