

Advanced Machining Processes - Video course

COURSE OUTLINE

This course on 'Advanced Machining Processes' is also known as "Unconventional Machining Processes", "Modern Machining Processes", and "New Technology". It deals with the latest machining processes named as "Advanced Machining Processes". They have been divided into three parts:

- Part 1 deals with mechanical type advanced machining processes such as Ultrasonic machining, water jet machining, abrasive water jet machining. It also includes micro-/nano-finishing processes viz, abrasive flow finishing, magnetic abrasive finishing, etc.
- Part 2 deals with thermal machining processes for example, electric discharge machining, laser beam machining, electron beam machining, etc.
- Part 3 elaborates chemical and electrochemical machining processes. It includes some hybrid machining processes namely, electrochemical grinding, electric discharge grinding and similar others.

COURSE DETAIL

Sl.No	Topics	Hours
1.	INTRODUCTION <ul style="list-style-type: none"> • Why do we need advanced machining processes (AMPs)? • Advanced machining processes • Remarks 	1
2.	MECHANICAL ADVANCED MACHINING PROCESSES <ul style="list-style-type: none"> • ABRASIVE JET MACHINING (AJM) - Introduction - Abrasive Jet Machining Setup - Gas Propulsion System - Abrasive Feeder - Machining Chamber - AJM Nozzle - Abrasives. • PARAMETRIC ANALYSIS - Stand-off-Distance - Abrasive Flow Rate - Nozzle Pressure - Mixing Ratio. • PROCESS CAPABILITIES • APPLICATIONS • PROBLEMS 	2
3.	ULTRASONIC MACHINING (USM) <ul style="list-style-type: none"> • INTRODUCTION • ULTRASONIC MACHINING SYSTEM 	2



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<http://nptel.iitm.ac.in>

Mechanical Engineering

Pre-requisites:

The candidate/reader should have the background of metal cutting and basics of physics and chemistry.

Additional Reading:

- Related research papers.
- ASM Handbooks.

Coordinators:

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	<ul style="list-style-type: none"> • MECHANICS OF CUTTING • PARAMETRIC ANALYSIS • PROCESS CAPABILITIES • APPLICATIONS • PROBLEMS 	
4.	<p>ABRASIVE FLOW FINISHING</p> <ul style="list-style-type: none"> • ABRASIVE FLOW FINISHING • WORKING PRINCIPLE • ABRASIVE FLOW MACHINING SYSTEM - Machine - Tooling - Media. • PROCESS VARIABLES • PROCESS PERFORMANCE • ANALYSIS AND MODELING OF ABRASIVE FLOW MACHINED SURFACES - Number of Active Grains - Wear of Abrasive Grains. • APPLICATIONS - Aerospace - Dies and Molds. • REVIEW QUESTIONS 	2
5.	<p>MAGNETIC ABRASIVE FINISHING (MAF)</p> <ul style="list-style-type: none"> • INTRODUCTION • WORKING PRINCIPLE OF MAF • MATERIAL REMOVAL (OR STOCK REMOVAL) AND SURFACE FINISH - Bonded and Unbonded Magnetic Abrasives - Machining Fluid - Magnetic Flux Density. • ANALYSIS • REVIEW QUESTIONS 	2
6.	<p>WATER JET CUTTING (WJC)</p> <ul style="list-style-type: none"> • INTRODUCTION • WJM MACHINE • PROCESS CHARACTERISTICS • PROCESS PERFORMANCE • APPLICATIONS • BIBLIOGRAPHY • SELF TEST QUESTIONS • REVIEW QUESTIONS 	1
7.	<p>ABRASIVE WATER JET MACHINING (AWJM)</p> <ul style="list-style-type: none"> • WORKING PRINCIPLE • AWJM MACHINE - Pumping System - Abrasive 	2

	<p>Feed System - Abrasive Jet Nozzle - Catcher.</p> <ul style="list-style-type: none"> • PROCESS CHARACTERISTICS • WATER - Water Jet Pressure During Slotting - Water Flow Rate. • ABRASIVES - Abrasive Flow Rate - Abrasive Particle Size - Abrasive Material. • CUTTING PARAMETERS - Traverse Speed - Number of Passes - Stand-off-Distance - Visual Examination. • PROCESS CAPABILITIES • APPLICATIONS • REVIEW QUESTIONS 	
8.	<p>THERMOELECTRIC ADVANCED MACHINING PROCESSES</p> <p>ELECTRIC DISCHARGE MACHINING (EDM)</p> <ul style="list-style-type: none"> • INTRODUCTION • WORKING PRINCIPLE OF EDM • R-C PULSE GENERATOR • EDM MACHINE - Power Supply - Dielectric System - Electrodes - Servo system - Electrode Refeeding - Power Delivered to the Discharging Circuit. • CNC-EDM • ANALYSIS - Analysis of R-C Circuits - Current in discharging Circuit - Material Removal in RC Circuits - Surface Finish. • PROCESS VARIABLES - Dielectric Pollution and its Effects. • PROCESS CHARACTERISTICS - Gap Cleaning. • APPLICATIONS 	3
9.	<p>ELECTRIC DISCHARGE GRINDING (EDG) AND ELECTRIC DISCHARGE DIAMOND GRINDING (EDDG)</p> <ul style="list-style-type: none"> • ELECTRIC DISCHARGE GRINDING • ELECTRICAL DISCHARGE DIAMOND GRINDING - Working Principle - Capabilities and Applications. 	1.5
10.	<p>WIRE ELECTRIC DISCHARGE MACHINING</p> <ul style="list-style-type: none"> • WORKING PRINCIPLE • WIRE EDM MACHINE - Power Supply System - Dielectric System - Positioning System - Wire Drive System. • ADVANCES IN WIRECUT • STRATIFIED WIRE 	1.5

	<ul style="list-style-type: none"> • PROCESS VARIABLES • PROCESS CHARACTERISTICS • APPLICATIONS • PROBLEMS • REVIEW QUESTIONS 	
11.	<p>LASER BEAM MACHINING</p> <ul style="list-style-type: none"> • PRODUCTION OF LASERS • WORKING PRINCIPLE OF LASER BEAM MACHINING • TYPES OF LASERS - Solid Lasers - Gas Lasers. • PROCESS CHARACTERISTICS • APPLICATIONS - Drilling - Cutting - Marking - Miscellaneous Applications. • REVIEW QUESTIONS 	3
12.	<p>PLASMA ARC MACHINING</p> <ul style="list-style-type: none"> • WORKING PRINCIPLE • PLASMA ARC CUTTING SYSTEM • ELEMENTS OF A PLASMA ARC CUTTING SYSTEM • PROCESS PERFORMANCE • APPLICATIONS • REVIEW QUESTIONS 	1
13.	<p>ELECTRON BEAM MACHINING</p> <ul style="list-style-type: none"> • WORKING PRINCIPLE • ELECTRON BEAM MACHINING SYSTEM - Electron Beam Gun - Power Supply - Vacuum System and Machining Chamber. • PROCESS PARAMETERS • CHARACTERISTICS OF THE PROCESS • APPLICATIONS • PROBLEMS 	2
14.	<p>FOCUSSED ION BEAM MACHINING</p> <p>Working Principle - FIB machining system - Parametric analysis - Applications - Problems.</p>	2
15.	<p>ELECTROCHEMICAL AND CHEMICAL ADVANCED MACHINING PROCESSES</p> <p>ELECTROCHEMICAL MACHINING</p>	4

	<ul style="list-style-type: none"> • INTRODUCTION • ELECTROLYSIS • ELECTROCHEMICAL MACHINING (ECM) • ECM MACHINE TOOL - Power Source - Electrolyte Supply and Cleaning System - Tool and Tool Feed System - Workpiece and Work Holding Device. • ADVANTAGES AND LIMITATIONS • APPLICATIONS • MECHANICAL PROPERTIES OF ECM'D PARTS • THEORY OF ECM - Faraday's Laws of Electrolysis. • ELECTROCHEMICAL EQUIVALENT OF ALLOYS - Material Removal Rate in ECM - Inter-electrode Gap in ECM - Zero Feed Rate - Finite Feed Rate - Self Regulating Feature - Generalized Equation for Inter-electrode Gap. • MAXIMUM PERMISSIBLE FEED RATE IN ECM • ELECTROLYTE CONDUCTIVITY (K) - Temperature - Hydrogen Bubbles. • PROBLEMS 	
16.	<p>ELECTROCHEMICAL GRINDING</p> <ul style="list-style-type: none"> • INTRODUCTION • ECG MACHINE TOOL • PROCESS CHARACTERISTICS • APPLICATIONS • REVIEW PROBLEMS 	1
17.	<p>ELECTROSTREAM DRILLING</p> <ul style="list-style-type: none"> • INTRODUCTION • PROCESS PERFORMANCE • BIBLIOGRAPHY • REVIEW QUESTIONS 	1
18.	<p>ELECTROCHEMICAL DEBURRING</p> <ul style="list-style-type: none"> • INTRODUCTION - Definition of Burr - Types of Burrs - Basic Approach on Deburring. • CLASSIFICATION OF DEBURRING PROCESSES • ELECTROCHEMICAL DEBURRING (ECD_e) - Principle of Working. • APPLICATIONS • SPECIFIC FEATURES OF ECD_e MACHINE 	1.5

