SUBJECT TITLE : UNCONVENTIONAL MANUFACTURING PROCESSES
SUBJECT CODE : 5026
PERIODS/WEEK : 4
PERIODS/SEMESTER : 72
CREDIT : 4

TIME SCHEDULE

MODULE	TOPIC	PERIODS
1.		
	1.1. Introduction to unconventional manufacturing	2
	1.2. Unconventional machining processes	2
	1.3. Mechanical machining processes	7
	1.4. Chemical machining processes	7
2.	2.1 Electro chemical machining processes	8
	2.2 Thermo-electrical machining processes (fusion)	9
	Test – I	2
3.		
	3.1 Thermo-electrical machining processes (vapourisation)	17
4.		
	4.1. Other unconventional manufacturing processes/techniques	1
	4.2. Welding	5
	4.3. Forming	5
	4.4. Electronic device manufacturing	6
	Test – II	2
	TOTAL	**72**

OBJECTIVES

Upon completion of the study of this subject, the student should be able to :

Module-I

1.1.0 Define unconventional machine process

1.1.1 Concept of MRR, accuracy, surface finish, constraints etc.
1.2.0 Different type process and classification
1.2.1 Explain hybrid process
1.3.0 Mechanical process
1.3.1 Understand USM -Ultra Sonic Machining
1.3.2 Understand AJM -Abrasive Jet Machining
1.4.0 Chemical process
1.4.1 Understand CHM-Chemical Machining

Module II

2.1.0 Understand ECM- **Electro Chemical Machining**
2.2.0 Understand **Thermo-electrical (fusion)** Machining
2.2.1 IBM - Ion Beam Machining
2.2.2 PAM – Plasma Arc Machining

Module III

3.1.0 Understand **Thermo-electrical (vapourisation)** Machining
3.1.1 EDM- Electrical Discharge Machining
3.1.2 EBM – Electron Beam Machining
3.1.3 LBM – Laser Beam Machining
3.2.0 Hybrid process

Module IV

4.1.0 Under stand nonconventional welding process

4.1.1 LBW – Laser Beam Welding
4.1.2 EBW – Electron Beam Welding
4.1.3 Explosion welding,
4.1.4 Explosion cladding
4.2.0 Under stand nonconventional forming process
4.2.1 High Energy Forming processes.
4.2.2 Explosive forming,
4.2.3 High velocity forming
4.30 **B**rief description of diffusion and Photo – Lithography process

CONTENTS

Concept of metal MRR (Material Removal Rate)
comparison between conventional and Non-conventional machining process based on mrr, power consumption, accuracy etc. typical surface finish from various nontraditional material removal process, performance constraints, selection of non conventional manufacturing, hybrid processes. Classifications: based on type of Energy used: Mechanical, Chemical, Electro - chemical Thermo-electrical

USM- Ultra Sonic Machining:
working principle, set up for USM. Tooling – Tool Holder, tool materials, tool size . Abrasive slurry. Effect of amplitude and frequency and vibration, Effect of grain size, Effect of applied static load, Effect of slurry, Process characteristics MRR , accuracy, surface finish, Merits & limitations. Applications of USM

AJM- Abrasive Jet Machining.
working principle, set up for AJM, Elements of AJM -& their effects on the AJM process. Factors affecting AJM:- Carrier Gas, Type of abrasive, Size of abrasive grain, velocity of the abrasive jet, Mean No. abrasive particles per unit volume of the carrier gas, Work material, standoff distance(SOD), nozzle design, Shape of cut.
Process characteristics mrr, accuracy, surface finish.
Merits & limitations. Applications: delicate cleaning, machining of brittle & heat sensitive materials.

CHM-Chemical Machining
.Chemical Blanking: steps- preparation of work piece, masters, masking, Etching, Typical Maskant & etchant materials for work materials such as stain less steel, tool steel, tungsten, zirconium. Process characteristics MRR , accuracy, surface finish
.Chemical Milling (Contour Milling): steps- preparation of work piece, masters, masking.
Typical Maskant & etchant materials for aluminum ferrous metal work materials.
Process characteristics MRR , accuracy, surface finish, Hydrogen embrittlement.
Merits & limitations, Application.

MODULE II

ECM- **Electro Chemical Machining.**
working principle, set up for ECM, machine: essential characteristics of machine , power supply Electrolytes: functions & circulation system of electrolytes.
Tooling –tool & insulation materials, tool size , electrolyte flow arrangements in tools - convergent & divergent, handling of slug.
Process characteristics_ factors affecting the MRR, accuracy, surface finish, HAZ (Heat Affected Zone). Merits & limitations. Application : cavity sinking, drilling & trepanning, Electro Chemical Turning, Electro Chemical sawing , Electro Chemical cutting off, Electro chemical honing, Electro chemical deburring ,

Electro Chemical Grinding (ECG)& Electro Chemical Discharge Grinding (ECDG),

Thermo-electrical (fusion)

IBM - Ion Beam Machining.

working principle, & set- up for PAM. Process characteristics_MRR , accuracy, surface finish, HAZ (Heat Affected Zone). Selection of gas. Merits & limitations & Applications

PAM – Plasma Arc Machining

working principle, Equipment, & set- up for PAM non-thermal generation of plasma, selection of gas, Mechanism of Metal removal. Process characteristics MRR , accuracy, surface finish, HAZ (Heat Affected Zone). Selection of gas. Merits & limitations & Applications

UNIT III

Thermo-electrical (Vaporisation

EDM- Electrical Discharge Machining

working principle, set up for EDM, die – electric fluids & their desirable ualities, spark generator & its functions, tools & tool holders **- electrodes**-classification of tool materials-manufacturing methods , advantages & limitations, applications of copper, graphite, tungsten, steel, aluminum, zinc & their combinations, electrode wear –factors affecting wear. tool holders- types. Flushing pressure, suction, side , pulsed & synchronized. Process charecteristics_MRR , accuracy, surface finish, HAZ (Heat Affected Zone). Merits & limitations.

Applications:_.

EBM – Electron Beam Machining - working principle, & set- up for EBM. . Process charecteristics_MRR , accuracy, surface finish, HAZ (Heat Affected Zone)._Merits & limitations. Applications:

LBM – Laser Beam Machining Types of lasers- solid state pulsed, CO_2 gas. Production of LASER from Ruby rod. CO_2 gas LASER system. working principle, & set- up for LBM. Process charecteristics MRR , accuracy, surface finish, HAZ (Heat Affected Zone). Merits & limitations & Applications: for machining different materials, lazer beam cutting with gas.

Hybrid process

Working of hybrid process such as ECG,EDG,ECDG etc

MODULE IV

LBW – Laser Beam Welding

- working principle, & set- up for LBW. Process characteristics, weld thickness, work materials, weld finish, HAZ (Heat Affected Zone). Merits & limitations & Applications

EBW – Electron Beam Welding

- working principle, & set- up for EBW. Process charecteristics, wled thickness, work materials, weld finish, HAZ (Heat Affected Zone). Merits & limitations & Applications

Explosion welding , Explosion cladding

FORMING PROCESS

High Energy Forming processes. explosive forming, high velocity forming

ELECTRONIC DEVICE MANUFACTURING

Brief description of diffusion and Photo – Lithography process for electronic device manufacturing.

TEXT BOOKs

1. Production Technology, by HMT. TATA McGraw Hill.
2. Manufacturing Science-Amitabh Ghosh , Mallik- East-West (? Wiley Eastern)

REFERENCES

1. Non conventional Machining -P.K. Mistra- Narvasa Publishining House
2. New Technology – Bhattayacharya- Institution of Engrs (India)
3. Rapid Prototyping… A Brief Introduction - Amitabha Ghosh, East West Publishers.
4. Un conventional Machining V. K. Jain
5. Modern Machining processes P C Pandey