Ref No:

SRI KRISHNA INSTITUTE OF TECHNOLOGY, BENGALURU



COURSE PLAN

Academic Year 2019 – 20

Program:	B E – MECHANICAL
Semester:	VIII
Course Code:	17ME554
Course Title:	Non Traditional Machining
Credit / L-T-P:	3 / 3-0-0
Total Contact Hours:	40
Course Plan Author:	SRIDHAR H S

Academic Evaluation and Monitoring Cell

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Note: Remove "Table of Content" before including in CP Book

Each Course Plan shall be printed and made into a book with cover page

Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	ME
Year / Semester :	5/V	Academic Year:	2018-19
Course Title:	Non Traditional Machining	Course Code:	17ME554
Credit / L-T-P:	3/3-0-0	SEE Duration:	3 hours

17ME554 / A & B

Total Contact Hours:	42	SEE Marks:	80Marks
CIA Marks:	20	Assignment	2/Module
Course Plan Author:	SHRIDHARA H S	Sign	Dt:
Checked By:		Sign	Dt:

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

in G.				, , , , , , , , , , , , , , , , , , , ,
Modu	Module Content	Teaching	Module Concepts	Bloom
le		Hours		S
			XX	Level
1		8	Non-traditional	L2
	Introduction to Non-traditional machining: Need for Non-		machining	
	traditional machining process, Comparison between			
	traditional and non-traditional machining, general			
	classification Nontraditional machining			
	processes, classification based on nature of energy employed			
	in machining, selection of non-traditional machining			
	processes, Specific advantages, limitations and applications			
	of non-traditional machining processes.			
2		4	Ultrasonic	L2
2	Ultrasonic Machining (USM): Introduction, Equipment		Machining process.	
	and material process, Effect of process parameters: Effect of		wacming process.	
	amplitude and frequency, Effect of abrasive grain			
	diameter, effect of slurry, tool &work material. Process			
	characteristics: Material removal rate, tool wear, accuracy,			
	surface finish, applications, advantages &limitations of		Abrasive Jet	
	USM.		Machining process.	
	Abrasive Jet Machining (AJM): Introduction, Equipment	2		L2
	and process of material removal, process variables: carrier	2	Water Jet	
	gas, type of abrasive, work material, stand-off		Machining process.	
	distance(SOD). Process characteristics-Material removal rate,			
	Nozzle wear, accuracy & surface finish. Applications,			L2
	advantages & limitations of AJM.	2		
	Water Jet Machining (WJM): Equipment &process,			
	Operation, applications, advantages			
	and limitations of WJM.			
2				
3	Introduction, Principle of electro chemical machining:			
	ECM equipment, elements of ECM Operation, Chemistry of		electro chemical	
	ECM. ECM Process characteristics: Material removal rate,		machining process	L2
	accuracy, Surface finish. Process parameters: Current		01	
	density, Tool feed rate, Gap between tool &work piece,	5		
	velocity of electrolyte flow, type of electrolyte, its			
	concentration temperature, and choice of Electrolytes. ECM			
	Tooling: ECM tooling technique &example, Tool			
	&insulation materials. Applications ECM: Electrochemical		Chemical	
	grinding and electrochemical honing process. Advantages,		machining process	
	disadvantages and application of ECM.		macining process	
	and application of Dom.	5		L2
	CHM Elements of the process: Resists (maskants),			
	<u> </u>			
	Etchants. Types of chemical machining process chemical			
	Blanking process, chemical milling process. Process			
	characteristics of CHM: material removal rate, accuracy,			

surface finish, advantages, limitations and applications of chemical machining process.			
Introduction, mechanism of metal removal, EDM equipment: spark erosion generator (Relaxation type), dielectric medium-its functions &desirable properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current &spark gap, surface finish, Heat Affected Zone. Advantages, limitations &applications of EDM, Electrical discharge	4	Electrical Discharge machining process Plasma arc machining process	L2
grinding, Traveling wire EDM. PLASMA ARC MACHINING (PAM) Introduction, non-thermal generation of plasma, equipment mechanism of metal removal, Plasma torch, process parameters, process characteristics. Safety precautions. Safety Precautions, applications, advantages and limitations.	5		L2
5 LASER BEAM MACHINING (LBM) Introduction, generation of LASER, Equipment and mechanism of metal removal, LBM Parameters and	4	Laser beam machining process	L2
characteristics, Applications, Advantages & limitations. ELECTRON BEAM MACHINING (EBM) Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations.	4	Electron beam machining process	L2

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

- 1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 30 minutes
- 2. Design: Simulation and design tools used software tools used ; Free \slash open source
- 3. Research: Recent developments on the concepts publications in journals; conferences etc.

Modu	Details	Available
le		
A	Text books (Title, Authors, Edition, Publisher, Year.)	
	Modern Machining Processes by P.C Panday and H. S Shah Tata McGraw-Hill	In Lib
	Education, India Pvt.Ltd. 2000	
	Non Traditional Machining by Kestor Praveen Suggi publication 2018	In dept
В	Reference books (Title, Authors, Edition, Publisher, Year.)	
1,2,3,	New Technology Dr. Amitabha Bhattacharyya, The Institute of Engineers 2000	In Lib
4,5		
C	Concept Videos or Simulation for Understanding	
C1	http://videos.vtu.ac.in/video_groups.php?group=Mechanical%20Engineeri	
	ng	
C2	https://www.youtube.com/watch?v=qVcwT0FfAIc	
C3	https://www.youtube.com/watch?v=pI1QGpmKqow	
C4	https://www.youtube.com/watch?v=QtJvJ3jscGA	
C5	https://www.youtube.com/watch?v=uA6wfkboWtg	
C6	https://www.youtube.com/watch?v=6ERbGtJFcBw	
<u>C7</u>	https://www.youtube.com/watch?v=EI2iakzRbeM	
C8	https://www.youtube.com/watch?v=lPMaASIBShA	
C9	https://www.youtube.com/watch?v=B-2nzWfJE-k	
C10	https://www.youtube.com/watch?v=dP2m7-WAdos	

D	Software Tools for Design	

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

Students must have learnt the following Courses / Topics with described Content . . .

SNo	Course	Course Name	Module / Topic / Description	Sem	Remarks	Blooms
	Code					Level
1	15ME35	Machine Tool and	1. Knowledge on marching operation	3/4	Plan Gap Course	L2
	A/45A	Operation				

Note: If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.

Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e.

New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modu	Topic / Description	Area	Remarks	Blooms
les				Level
1		Higher Study	Gap	Understand
			A seminar on PLCM model	L2

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs. Identify a max of 2 Concepts per Module. Write 1 CO per Concept.

#	Cos	T1-	Comment	Tuesta	A	Dlaama'
#	200	Teach.	Concept	Instr	Assessment	Blooms'
	students should be able to	Hours		Method	Method	Level
15ME55	Student should be able to	8	Non-traditional	Lecture/T	Assignment	L2
4.1	understand non traditional		machining	utorial		Understand
	machining process and need for it.					
15ME55		4	Ultrasonic	Lecture/T	Assignment	L2
15ME55		4	Machining	utorial	Assignment	Understand
4.2	understand constructional features		process.	utoriai		Chacistana
	and performance of USM.		process.			
15ME55	Student should be able to	2	Abrasive Jet	Lecture/T	Assignment	L2
4.3	understand constructional features		Machining	utorial		Understand
	and performance of AJM.		process.			
15ME55	-	2	Water Jet	Lecture/T	Assignment	L2
		2	Machining	utorial	7 tssignment	Understand
4.4	understand constructional features		process.	atoriar		Chacistana
	and performance of WJM.		•			
15ME55	Student should be able to	5	Electro	Lecture/T	Assignment	L2
4.5	understand constructional features		chemical	utorial		Understand
	and performance of ECM.		machining			
15) (5) (6)	•		process	T . //D		
	Student should be able to understand	5	Chemical	Lecture/T	Assignment	L2
6	constructional features and performance of CHM.		machining	utorial		Understand
15MD554		4	process	I a atoma /T	A:	1.0
15ME554.	Student should be able to understand	4	Electrical	Lecture/T utorial	Assignment	L2 Understand
/	constructional features and performance of EDM.		Discharge	utorial		Understand
	OI EDIVI.		machining			
			process			

15ME554.	Student should be able to understand	4	Plasma arc	Lecture/T	Assignment	L2
8	constructional features and performance		machining	utorial		Understand
	of PAM.		process			
15ME554.	Student should be able to understand	4	Laser beam	Lecture/T	Assignment	L2
9	constructional features and performance		machining	utorial		Understand
	of LBM.		process			
15ME554.	Student should be able to understand	4	Electron beam	Lecture/T	Assignment	L2
10	constructional features and performance		machining	utorial		Understand
	of EBM.		process			
-	Total	42	-		·	

Note: Identify a max of 2 Concepts per Module. Write 1 CO per concept.

2. Course Applications

Write 1 or 2 applications per CO.

Students should be able to employ / apply the course learnings to . . .

	is should be use to employ, upply the course realisings to		
Modu	A A	CO	Level
les	Compiled from Module Applications.		
1	Manufacturing industries	CO1	L2
2	Threading of various glass and ceramic material.	CO2	L2
3	Removing glue and paint from leather objectives	CO3	L2
4	Cleaning and descaling operation	CO4	L2
5	Facing and turning of 3D object.	CO5	L2
6	Grinding of carbide tool	CO6	L2
7	Turning of metallic object	CO7	L2
8	Arc spraying on surface	CO8	L2
9	Welding of material	CO9	L2
10	Finishing Injector nozzle of diesel engine	CO10	L2

4. Mapping Justification

Map	ping	Justification	Mapping Level
СО	PO	_	Level
CO1	PO1	Engineering Knowledge Acquisition of Engineering knowledge on fundamentals of traditional and non-traditional machining process. is essential to accomplish solutions to complex engineering problems in Machining process	
CO2	PO1	Engineering Knowledge Acquisition of Engineering knowledge on constructional features and performance of USM	L2
CO3	PO1	Engineering Knowledge Acquisition of Engineering knowledge on fundamentals of constructional features, performance parameters of AJM.	L2
CO4	PO1	Engineering Knowledge: Acquisition of Engineering knowledge on fundamentals of Constructional features and performance of WJM is essential to accomplish solutions to complex engineering problems in managing modern machining process.	
CO5	PO1	Engineering Knowledge Acquisition of Engineering knowledge on fundamentals of Constructional features and performance of ECM.	L2
CO5	PO6	understanding the Constructional features and performance of ECM and Educate students about environmental and safety issues.	L2
CO6	PO1	Engineering Knowledge Acquisition of Engineering knowledge on fundamentals of constructional features and performance of CHM.	L2
CO6	PO6	Educate students about environmental and safety issues of CHM.	L2
CO7	PO1	Engineering Knowledge Acquisition of Engineering knowledge on fundamentals of constructional features and performance of EDM using new technology.	

CO7	PO6	Educate students about environmental and safety issues. When performing the EDM process.	L2
CO8	PO1	Student should be able to understand constructional features and performance of PAM.	L2
CO8	PO6	constructional features and performance of PAM. by various approaches of product manufacturing.	L2
CO9	PO1	constructional features and performance of LBM by various approaches of product machining	L2
CO9	PO6	Educate students about environmental and safety issues when performing LBM machining process	L2
CO10	PO1	Engineering Knowledge Acquisition of Engineering knowledge on fundamentals of constructional features and performance of EBM. is essential to accomplish solutions to complex engineering problems in machining process	L2
CO10	PO6	Educate students about environmental and safety issues when performing EBM machining process	L2

Note: Write justification for each CO-PO mapping.

4. Articulation Matrix

(CO – PO MAPPING)

-	-	Course Outcomes					Progr											
Modules	#	COs	PO1			PO4	PO5		PO7	PO8	PO9				PSO		PS	Lev
				2	3			6				0	11	12	1	O2	O3	el
1		Student should be able		-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
	1	to understand non																
		traditional machining																
		process and need for																
2	15) (555.4	it.																1.0
2		Student should be able		-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
	2	to understand constructional features																
		and performance of																
		USM.																
3		Student should be able		-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
	3	to understand																
		constructional features																
		and performance of AJM.																
4	15ME554.	Student should be able		-	-	-	-	-	-	-	-	-	-	-	-	-	-	L2
	4	to understand																
		constructional features																
		and performance of																
		WJM.						,										
5		Student should be able		-	-	-	-		-	-	-	-	-	-	-	-	-	L2
	5	to understand																
		constructional features																
		and performance of ECM.																
6	15ME554.	Student should be able		-	-	-	-		-	-	-	-	-	-	-	-	-	L2
	6	to understand																
		constructional features																
		and performance of CHM.																
7	15ME554	Student should be able	V	_	_	_			_	_	_	_	_	-	_	_	_	L2
,	7	to understand	٧					٧										
		constructional features																
		and performance of																
		EDM.																
8	15ME554.	Student should be able		-	-	-	-		-	-	-	-	-	-	-	-	-	L2
	8	to understand																
		constructional features																

		and performance of PAM.																
9	15ME554.	Student should be able		-	-	-	-		-	-	-	-	-	-	-	-	-	L2
	9	to understand																
		constructional features																
		and performance of																
		LBM.																
10	15ME554.	Student should be able		-	-	-	-		-	-	-	-	-	-	-	-	-	L2
	10	to understand																
		constructional features																
		and performance of																
		EBM.																
-	15ME554	Average attainment		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		(1, 2, or 3)																
-	PO, PSO	1.Engineering Knowled	lge;	2.Pr	oblei	m An	alysis	s; 3.1	Desig	n/L	Pevel	орте	nt o	f Sol	lutior	ıs; 4	.Con	iduct
		Investigations of Con	ıplex	Pro	obler	ns; .	5. <i>Mo</i> a	lern	Too	l Us	age;	6.Th	ie E	ngin	eer	and	Soc	iety;
		7.Environment and Su	stair	ıabil	ity;	8.Eti	hics;	9. <i>Inc</i>	divid	ual d	and Z	Геат	work	k; 10	0.Coi	mmu	nica	tion;
		11.Project Managemen	Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data															
		Base Management; S3.	Web .	Desi	ign													

5. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1	Digital machining process	1 day seminar on			
		DMP			

Note: Write Gap topics from A.4 and add others also.

6. Content Beyond Syllabus

Modu	Gap Topic	Area	Actions Planned	Schedule Planned	Resources	PO Mapping
les					Person	
3	Machining Quality analysis process	GATE, Higher Study, Entrepreneurship.	1 day workshop			

Note: Anything not covered above is included here.

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Mod	Title	Teaching			of quest	ion in I	Exam		CO	Levels
ule#		Hours	CIA-1	CIA-2	CIA-3	Asg	Extra	SEE		
							Asg			
1	Introduction to Non-traditional	8	2	-	-	1	1	2	CO1,	L2
	machining									
2	Ultrasonic Machining(USM),	8	2	-	-	1	1	2	CO2	L2
	Abrasive Jet Machining (AJM),								CO3,	
	Water Jet Machining (WJM):								CO4	
3	Electrochemical	10	-	2	-	1	1	2	CO5,	L2
	Machining(ECM)								CO6	
	Chemical Machining(CHM)									
4	Electrical Discharge	8	-	2	-	1	1	2	CO7,	L2
	machining(EDM)								C08	

17ME554 / A & B

	PLASMA ARC MACHINING (PAM)									
4	LASER BEAM MACHINING (LBM) ELECTRON BEAM MACHINING (EBM)	8	-	-	4	1	1	2	CO9, CO10	L2
-	Total	42	4	4	4	5	5	10	-	-

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Evaluation	Weightage in Marks	СО	Levels
CIA Exam – 1	15	CO1, CO2, CO3, CO4	L2
CIA Exam – 2	15	CO5, CO6, CO7, C08	L2
CIA Exam – 3	15	CO9, CO10	L2
	0.7	GO1 GO2 GO2 GO1	* 2
Assignment - 1	05	CO1, CO2, CO3, CO4	L2
Assignment - 2	05	CO5, CO6, CO7, CO8	L2
Assignment - 3	05	CO9, CO10	L2
Other Activities – define – Slip test			
Final CIA Marks	20	-	-
Seminar - 3	_	_	-
Other Activities define – Slip test			
Final CIA Marks	20	-	-

D1. TEACHING PLAN - 1

Title:	Management, Planning	Appr	10 Hrs
	8	Time:	
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Student should be able to understand non traditional machining process and need	CO1	L2
	for it.		
b	Course Schedule	-	-
Class No	Module Content Covered	CO	Level
1	Introduction to Non-traditional machining	C01	L2
2	Need for Non-traditional machining process,	C01	L2
3	Comparison between traditional and non-traditional machining,	C01	L2
4	General classification Nontraditional machining processes,	C01	L2
5	Classification based on nature of energy employed in machining	C01	L2
6	Selection of non-traditional machining processes,	C01	L2
7	Specific advantages, limitations	C01	L2
8	Applications of non-traditional machining processes	C01	L2
С	Application Areas	CO	Level
1	Manufacturing industries	CO1	L2

d	Review Questions	-	-
1	Justify the need of unconventional manufacturing process in today industries.	CO1	L2
2	Differentiate between conventional and Non-conventional manufacturing process .	CO1	L2
3	Explain how the non- conventional machining processes are classified.	CO1	L2
4	List and explain the various factors to be considered for selection of machining processes .	CO1	L2
5	Make a comparison between traditional and non-traditional machining process in terms of cost ,application, scope, machine time and limitations.	CO1	L2
e	Experiences	-	-
1			

	Organizing And Staffing	Appr Time:	10 Hrs
a	Course Outcomes	-	Blooms
-	The student should be able to:	_	Level
1	understand constructional features and performance of USM	CO2	L2
2	understand constructional features and performance of AJM.	CO3	L2
3	understand constructional features and performance of WJM.	CO4	L2
b	Course Schedule	-	-
Class No	Module Content Covered	CO	Level
1	Ultrasonic Machining (USM): Introduction, Equipment and material process,	CO2	L2
2	Effect of process parameters: Effect of amplitude and frequency	CO2	L2
3	Effect of abrasive grain diameter, effect of slurry, tool &work material.	CO2	L2
4	Process characteristics: Material removal rate, tool wear, accuracy, surface finish, applications, advantages &limitations of USM.	CO2	L2
5	Abrasive Jet Machining (AJM): Introduction, Equipment and process of material removal, process variables: carrier gas, type of abrasive, work material, stand-off distance(SOD).	CO3	L2
6	Process characteristics-Material removal rate, Nozzle wear, accuracy & surface finish. Applications, advantages & limitations of AJM.	CO3	L2
7	Water Jet Machining (WJM): Equipment &process,	CO4	L2
8	Operation, applications, advantages and limitations of WJM	CO4	L2
С	Application Areas	CO	Level
1	Threading of various glass and ceramic material.	CO2	L2
2	Removing glue and paint from leather objectives	CO3	L2
3	Cleaning and descaling operation	CO4	L2
d	Review Questions	-	-
6	Explain with help of a neat sketch the working principle of ultra-sonic machining process, and also mention its advantages.	CO2	L2
7	Explain how various process parameters influences the material removal rate in ultrasonic machining process	CO2	L2
8	What are the advantages and disadvantages of USM	CO2	L2
9	Explain with graph the effect of various parameters on material removal rate in USM process	CO2	L2
	State and explain the working and principle of AJM	CO2	L2
10	State and explain the working and principle of AJW	CO2	

12	Explain the desired properties of abrasive material used in abrasive jet machining	CO2	L2
13	Explain how following parameters influences the material removal rate in abrasive		L2
	jet machining process i) Nozzle tip distance ii) Velocity of abrasive iii) abrasive flow		
	rate iv) Gas pressure		
14	What are the different types of abrasives used in ASM	CO3	L2
15	How does ASM differ from conventional sand blasting process	CO3	L2
16	Mention the advantages and disadvantages of WJM	CO4	L2
17	Which are the abrasive materials used in water jet machining	CO4	L2
e	Experiences	-	-
1			
2			
5			

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs C	Code:	15ME554	Sem:	V	Marks:	30	Time: 75	minutes		
Cour	se:	Non Traditio	nal Machin	ing						
-	-	Note: Answ	er any 2 qu	estions, ea	ch carry equal i	narks.		Marks	CO	Level
1	a	Justify the industries.	need of un	s 7	CO1	L2				
	b	What are the process.	ne differenc	e between	conventional a	nd non co	onventional machinin	g 8	CO1	L2
					OR					
2	a	Explain with	neat diagra	m construc	tion and working	g of USM	processes.	7	CO2	L2
	b	Write a note	on process	capability o	of USM.			8	CO2	L2
3	a	With neat sk	etch explair	the worki	ng of abrasive jet	machinin	g.	8	CO3	L2
	b	What are t machining?	What are the process variables that affect the performance of abrasive jet machining?							L2
				·	OR		·			
4	a	With neat sk	etch explair	the worki	ng principle of w	ater jet ma	chining.	8	CO4	L2
	b	What are the	advantages	and disad	vantages of water	jet machi	ning.	7	CO4	L2

b. Assignment -1

				Mode	l Assignment	Ouestions				
Crs Co	ode:	15ME554	Sem:	5	Marks:	5 /	Time:	90 – 120 n	ninutes	
Course	e:	Non Trad	itional Machini	ng	-		<u> </u>			
Note:	Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.									
SNo		USN		Assig	gnment Desc	ription		Marks	CO	Level
1			Justify the ne industries.	ed of uncon	ventional ma	nufacturing	g process in toda	ay 5	CO1	L2
2			Differentiate manufacturing	between process.	conventional	and	Non-convention	al 5	CO2	L2
3	3 Explain how the non- conventional machining processes are classified							CO2	L2	
4			List and expla machining pro-		s factors to b	e consider	red for selection	of 5	CO1	L2
5							aditional machini machine time a	_	CO1	L2
6			Explain with h machining pro	*		U 1	nciple of ultra-sor	ic 8	CO2	L2
7			Explain how removal rate in				ences the materi	al 5	CO2	L2

9	What are the advantages and disadvantages of USM	5	CO2	L2
	Explain with graph the effect of various parameters on material	5	CO2	L2
	removal rate in USM process			
10	State and explain the working and principle of AJM	8	CO3	L2
11	List the application of AJM	5	CO3	L2
12	Explain the desired properties of abrasive material used in abrasive jet	5	CO3	L2
	machining			
13	Explain how following parameters influences the material removal rate	5	CO3	L2
	in abrasive jet machining process i) Nozzle tip distance ii) Velocity of			
	abrasive iii) abrasive flow rate iv) Gas pressure			
14	What are the different types of abrasives used in ASM	5	CO3	L2
15	How does ASM differ from conventional sand blasting process	5	CO3	L
16	Mention the advantages and disadvantages of WJM	5	CO4	L2
17	Which are the abrasive materials used in water jet machining	5	CO4	L
18	Justify the need of unconventional manufacturing process in today	5	CO ₄	L
10	industries.	3	COI	L
19	Differentiate between conventional and Non-conventional	5	CO2	L2
	manufacturing process .			
20	Explain how the non- conventional machining processes are classified.		CO2	L
21	List and explain the various factors to be considered for selection of	5	CO1	L
22	machining processes . Make a comparison between traditional and non- traditional machining	5	CO1	L
L L	process in terms of cost application, scope, machine time and	3	COI	L.
	limitations.			
23	Explain with help of a neat sketch the working principle of ultra-sonic	8	CO2	L
۷3	machining process, and also mention its advantages.	0	CO2	L.
24	Explain how various process parameters influences the material	5	CO2	L
	removal rate in ultra-sonic machining process	5	002	L.
25	What are the advantages and disadvantages of USM	5	CO2	L
26	Explain with graph the effect of various parameters on material	5	CO2	L
20	removal rate in USM process	5	CO2	L.
27	State and explain the working and principle of AJM	8	CO3	L
28	List the application of AJM	5	CO3	L
29	Explain the desired properties of abrasive material used in abrasive jet	5	CO3	L
29	machining	3	003	L
30	Explain how following parameters influences the material removal rate	5	CO3	L
	in abrasive jet machining process i) Nozzle tip distance ii) Velocity of	3	003	
	abrasive iii) abrasive flow rate iv) Gas pressure			
31	What are the different types of abrasives used in ASM	5	CO3	L
32	How does ASM differ from conventional sand blasting process	5	CO3	L
33	Mention the advantages and disadvantages of WJM	5	CO4	L
34	Which are the abrasive materials used in water jet machining	5	CO4	L
35	Justify the need of unconventional manufacturing process in today	5	CO ₄	L
	industries.	J		L.
36	Differentiate between conventional and Non-conventional	5	CO2	L
	manufacturing process .	5		L.
37	Explain how the non- conventional machining processes are classified.		CO2	L
38	List and explain the various factors to be considered for selection of	5	CO1	L
٥٥	machining processes .	J	COI	L.
39	Make a comparison between traditional and non- traditional machining	5	CO1	L
	process in terms of cost ,application, scope, machine time and			
	limitations.			
40	Explain with help of a neat sketch the working principle of ultra-sonic	8	CO2	L
40	machining process, and also mention its advantages.			<u></u>
40	Explain how various process parameters influences the material	5	CO2	L
40	Explain now various process parameters influences the material			
	removal rate in ultra-sonic machining process			
		5	CO2	L

44	State and explain the working and principle of AJM	5	CO3	L2
45	List the application of AJM	5	CO3	L2
46	Justify the need of unconventional manufacturing process in today industries.	5	CO3	L2
47	Differentiate between conventional and Non-conventional manufacturing process.	5	CO3	L2

D2. TEACHING PLAN - 2

The student should be able to: Understand constructional features and performance of ECM. Understand constructional features and performance of CHM. CO6 L2 Understand constructional features and performance of CHM. CO6 L2 b Course Schedule Class No Module Content Covered Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM Operation, Chemistry of ECM. ECM Operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, Surface finish. Process parameters: Current density, Tool feed rate, Gap between tool &work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of Electrolytes. ECM Tooling: ECM tooling technique &example, Tool &insulation materials. ECM Tooling: ECM tooling technique &example, Tool &insulation materials. Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECM CHM Elements of the process: Resists (maskants), Etchants. C6 L2 Types of chemical machining process chemical Blanking process, C6 L2 chemical milling process. C6 L2 Process characteristics of CHM: material removal rate, accuracy, surface finish C6 L2 advantages, limitations and applications of chemical machining process C6 L2	Title:	Introduction	Appr Time:	10 Hrs
Understand constructional features and performance of ECM. CO6 L2	a	Course Outcomes	-	Blooms
Description of Echanics of Echanics and performance of CHM. Course Schedule	-		-	Level
Description Course Schedule Course Schedule Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM ECM Operation, Chemistry of ECM. ECM Operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, C5 L2 ECM Process parameters: Current density, Tool feed rate, Gap between tool &work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of Electrolytes. ECM Tooling: ECM tooling technique &example, Tool &insulation materials. C5 L2 Applications ECM: Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECM Electrochemical principle of ECM Electrochemical principle of ECM Electrochemical machining process chemical Blanking process, C6 L2 Types of chemical machining process chemical Blanking process, C6 L2 Electrochemical milling process C6 L2 Electrochemical machining process Electrochemical principle Electrochemical machining process Electrochemical principle Electrochemical grinding Explain the machining process Electrochemical principle Electrochemical grinding Explain the minum process Explain in brief the following in chemical grinding processes Explain in brief the following in chemical grinding processes Explain in brief the following in chemical grinding Explain the minum principle of electrochemical grinding Explain Electrochemical Electrochemical grinding Explain in brief the following in chemical machining	1	Understand constructional features and performance of ECM.	CO5	L2
Class No Module Content Covered 1 Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM Operation, Chemistry of ECM. 2 ECM Operation, Chemistry of ECM. 2 ECM Process characteristics: Material removal rate, accuracy, Surface finish. 3 Process parameters: Current density, Tool feed rate, Gap between tool &work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of Electrolytes. 4 ECM Tooling: ECM tooling technique &example, Tool &insulation materials. C5 L2 Applications ECM: 2 Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECM 5 Electrochemical machining process (ECM CHM Elements of the process: Resists (maskants), Etchants. C6 L2 Types of chemical machining process chemical Blanking process, C6 L2 Elements of the process: Resists (maskants), Etchants. C6 L2 Elements of the process: Resists (maskants), Etchants. C6 L2 Elemental machining process, C6 L2 Elemental machining process Elemental machining Elemental machining Elemental machining Elemental machining Elemental machining Explain the mechanisms of metal removal on both cases and compare it with conventional grinding process Explain the principle of electrochemical grinding, with neat sketch Explain the principle of electrochemical grinding, with neat sketch Explain in brief the following in chemical machining processes Explain in the principle of electrochemical grinding, with neat sketch Explain in the principle o	2	Understand constructional features and performance of CHM.	CO6	L2
Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM Operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, Surface finish. Process parameters: Current density, Tool feed rate, Gap between tool &work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of Electrolytes. ECM Tooling: ECM tooling technique &example, Tool &insulation materials. Applications ECM: Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECM Electrochemical grinding and electrochemical honing process. Advantages, C6 L2 Types of chemical machining process chemical Blanking process, C6 L2 Types of chemical machining process chemical Blanking process, C6 L2 Endowment of the process characteristics of CHM: material removal rate, accuracy, surface finish C6 L2 advantages, limitations and applications of chemical machining process C6 L2 Davantages, limitations and applications of chemical machining process C6 L2 C7 Types of chemical machining process C6 L2 Davantages, limitations and applications of chemical machining process C6 L2 Davantages, limitations and applications of chemical machining process C6 L2 Davantages, limitations and applications of chemical machining process C7 L2 Davantages, limitations and applications of chemical machining process C7 L2 Davantages, limitations and applications of chemical machining process C7 L2 Davantages, limitations and applications of chemical machining process C7 L2 Davantages, limitations and applications of chemical machining process C7 L2 Davantages, limitations and applications of chemical machining Explain the mechanisms of metal removal on both cases and compare it with conventional grinding process Davantages and disadvantages of ECM C7 L2 Explain the principle of electro chemical grinding, with neat sketch C7 L2 Exp				
ECM Operation, Chemistry of ECM. 2	Class No			Level
Surface finish. 3 Process parameters: Current density, Tool feed rate, Gap between tool &work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of Electrolytes. 4 ECM Tooling: ECM tooling technique &example, Tool &insulation materials. 5 Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECM 6 CHM Elements of the process: Resists (maskants), Etchants. 7 Types of chemical machining process chemical Blanking process, 8 chemical milling process. 9 Process characteristics of CHM: material removal rate, accuracy, surface finish C6 L2 10 advantages, limitations and applications of chemical machining process C6 L2 c Application Areas C0 Level 1 Facing and turning of 3D object. C Grinding of carbide tool C Grinding of carbide tool C Grinding of carbide tool C With suitable sketches, explain the material removal mechanisms in electro chemical grinding Why electro chemical machining considered as chip less machining? Explain the mechanisms of metal removal on both cases and compare it with conventional grinding process 3 What are the advantages and disadvantages of ECM What are the factors that influences oxidation of ECM What are the factors that influences oxidation of ECM Explain the principle of electro chemical grinding, with neat sketch Explain the principle of electro chemical grinding Explain the frinciple of electro chemical grinding With the help of neat sketches, explain the different steps involved in chemical CO6 L2 contours	1	ECM Operation, Chemistry of ECM.		L2
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Applications ECM: Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECM CHM Elements of the process: Resists (maskants), Etchants. C6 L2 Types of chemical machining process chemical Blanking process, C6 L2 kchemical milling process. C6 L2 Process characteristics of CHM: material removal rate, accuracy, surface finish C6 L2 advantages, limitations and applications of chemical machining process C6 L2 c Application Areas C0 Level Facing and turning of 3D object. C05 L2 Grinding of carbide tool C06 L2 d Review Questions With suitable sketches, explain the material removal mechanisms in electro chemical C05 L2 grinding C05 L2 Why electro chemical machining considered as chip less machining? Explain the mechanisms of metal removal on both cases and compare it with conventional grinding process What are the advantages and disadvantages of ECM C05 L2 What are the factors that influences oxidation of ECM C05 L2 Explain the principle of electro chemical grinding, with neat sketch C05 L2 Explain in brief the following in chemical machining processes C06 L2 i. Maskants ii. Etchants With the help of neat sketches, explain the different steps involved in chemical C06 L2 Explain the principle steps involved in chemical milling to produce pockets and C06 L2 Explain the principle steps involved in chemical milling to produce pockets and C06 L2 Explain the principle steps involved in chemical milling to produce pockets and C06 L2 Explain the principle steps involved in chemical milling to produce pockets and C06 L2 Explain the principle steps involved in chemical milling to produce pockets and C06 L2 Explain the principle steps involved in chemical milling to produce pockets and C06 L2 Explain the principle steps involved in chemical milling to produce pockets and C06 L2	3	velocity of electrolyte flow, type of electrolyte, its concentration temperature, and	C5	L2
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Types of chemical machining process chemical Blanking process, chemical milling process. chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish davantages, limitations and applications of chemical machining process chaplication Areas chaplication Ar	6		C6	L2
9 Process characteristics of CHM: material removal rate, accuracy, surface finish 10 advantages, limitations and applications of chemical machining process 10 C6 L2 11 Facing and turning of 3D object. 12 Grinding of carbide tool 13 With suitable sketches, explain the material removal mechanisms in electro chemical grinding 14 Why electro chemical machining considered as chip less machining? Explain the mechanisms of metal removal on both cases and compare it with conventional grinding process 13 What are the advantages and disadvantages of ECM 14 What are the factors that influences oxidation of ECM 15 Explain the principle of electro chemical grinding, with neat sketch 16 Explain with diagram, working of electro chemical grinding 17 Explain in brief the following in chemical machining processes 18 With the help of neat sketches, explain the different steps involved in chemical CO6 L2 19 Explain the principle steps involved in chemical milling to produce pockets and CO6 L2 20 Explain the principle steps involved in chemical milling to produce pockets and CO6 L2 21 Explain the principle steps involved in chemical milling to produce pockets and CO6 L2 22 Explain the principle steps involved in chemical milling to produce pockets and CO6 L2 23 Explain the principle steps involved in chemical milling to produce pockets and CO6 L2 24 Explain the principle steps involved in chemical milling to produce pockets and CO6 L2	7		C6	L2
9 Process characteristics of CHM: material removal rate, accuracy, surface finish 10 advantages, limitations and applications of chemical machining process 10 C6 L2 11 Facing and turning of 3D object. 12 Grinding of carbide tool 13 With suitable sketches, explain the material removal mechanisms in electro chemical grinding 14 Why electro chemical machining considered as chip less machining? Explain the mechanisms of metal removal on both cases and compare it with conventional grinding process 13 What are the advantages and disadvantages of ECM 14 What are the factors that influences oxidation of ECM 15 Explain the principle of electro chemical grinding, with neat sketch 16 Explain with diagram, working of electro chemical grinding 17 Explain in brief the following in chemical machining processes 18 With the help of neat sketches, explain the different steps involved in chemical CO6 L2 19 Explain the principle steps involved in chemical milling to produce pockets and CO6 L2 20 Explain the principle steps involved in chemical milling to produce pockets and CO6 L2 21 Explain the principle steps involved in chemical milling to produce pockets and CO6 L2 22 Explain the principle steps involved in chemical milling to produce pockets and CO6 L2 23 Explain the principle steps involved in chemical milling to produce pockets and CO6 L2 24 Explain the principle steps involved in chemical milling to produce pockets and CO6 L2	8	chemical milling process.	C6	L2
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grinding 2 Why electro chemical machining considered as chip less machining? Explain the mechanisms of metal removal on both cases and compare it with conventional grinding process 3 What are the advantages and disadvantages of ECM 4 What are the factors that influences oxidation of ECM 5 Explain the principle of electro chemical grinding, with neat sketch 6 Explain with diagram, working of electro chemical grinding 7 Explain in brief the following in chemical machining processes i. Maskants ii. Etchants 8 With the help of neat sketches, explain the different steps involved in chemical blanking. 9 Explain the principle steps involved in chemical milling to produce pockets and contours	d		-	-
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4 What are the factors that influences oxidation of ECM 5 Explain the principle of electro chemical grinding, with neat sketch 6 Explain with diagram, working of electro chemical grinding 7 Explain in brief the following in chemical machining processes i. Maskants ii. Etchants 8 With the help of neat sketches, explain the different steps involved in chemical blanking. 9 Explain the principle steps involved in chemical milling to produce pockets and contours CO6 L2 CO6 L2	2	mechanisms of metal removal on both cases and compare it with conventional grinding process	CO5	L2
5 Explain the principle of electro chemical grinding, with neat sketch CO5 L2 6 Explain with diagram, working of electro chemical grinding CO5 L2 7 Explain in brief the following in chemical machining processes i. Maskants ii. Etchants 8 With the help of neat sketches, explain the different steps involved in chemical blanking. 9 Explain the principle steps involved in chemical milling to produce pockets and contours CO6 L2 CO6 L2	3			L2
6 Explain with diagram, working of electro chemical grinding CO5 L2 7 Explain in brief the following in chemical machining processes i. Maskants ii. Etchants 8 With the help of neat sketches, explain the different steps involved in chemical blanking. 9 Explain the principle steps involved in chemical milling to produce pockets and contours CO6 L2 L2 CO6 L2	4			
7 Explain in brief the following in chemical machining processes i. Maskants ii. Etchants 8 With the help of neat sketches, explain the different steps involved in chemical blanking. 9 Explain the principle steps involved in chemical milling to produce pockets and contours CO6 L2 L2 CO6 L2	5			+
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blanking. 9 Explain the principle steps involved in chemical milling to produce pockets and CO6 L2 contours	7	i. Maskants	CO6	L2
contours	8		CO6	L2
	9		CO6	L2
	10	List out the advantages and disadvantages of chemical machining	CO6	L2

11	List out major applications of CHM. Further process application related to improving the surface characteristics	CO6	L2
12	Explain the elements of chemical machining process	CO6	L2
13	Explain the mechanisms of metal removal on both cases and compare it with conventional grinding process	CO6	L2
14	Explain the principle steps involved in chemical milling to produce pockets and contours	CO6	L2
15	Why chemical machining considered as chip less machining?	CO6	L2
e	Experiences	-	-
1			
2			
3			
4			
5			

Module – 4

Title:	Present, future and annual worth and rate of returns	Appr Time:	10 Hrs
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Understand constructional features and performance of EDM.	CO7	L2
2	Understand constructional features and performance of PAM.	CO8	L2
b	Course Schedule		
Class No	Module Content Covered	CO	Level
1	Introduction, mechanism of metal removal, EDM equipment: spark erosion generator (Relaxation type),	CO7	L2
2	dielectric medium-its functions &desirable properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM	CO7	L2
3	process parameters: Spark frequency, current &spark gap, surface finish, Heat Affected Zone.	CO7	L2
4	Advantages, limitations & applications of EDM, Electrical discharge grinding, Traveling wire EDM.	CO7	L2
5	PLASMA ARC MACHINING (PAM) Introduction, non-thermal generation of plasma,	CO8	L2
6	equipment mechanism of metal removal, Plasma torch,	CO8	L2
7	process parameters, process characteristics.	CO8	L2
8	Safety precautions. Safety Precautions, applications, advantages and limitations.	CO8	L2
c	Application Areas	CO	Level
1	Turning of metallic object	CO7	L2
2	Arc spraying on surface	CO8	L2
d	Review Questions	_	_
1	Discuss the factors influencing the choice of electrode material in EDM	CO7	L2
2	Explain with help of a neat sketches any two types of flushing methods used in EDM	CO7	L2
3	Explain with help of neat sketches the mechanisms of metal removal in EDM process, and also mention its advantages and disadvantages	CO7	L2
4	Name some of the dielectric fluids commonly used in EDM. Name some of the tool material used in EDM	CO7	L2
5	What are the basic requirements of the dielectric fluid used in EDM	CO7	L2
6	With the help of neat sketch, explain wire cut electrical discharge machining	CO7	L2
7	With a neat sketch explain the Plasma arc machining (PAM) process and also mention its applications	CO8	L2
8	Which are the important considerations are to be made in the design of plasma torch	CO8	L2

9	Mention any two advantages and disadvantages of plasma arc machining	CO8	L2
10	Explain the basic principal of PAM	CO8	L2
11	Write the application of plasma arc machining	CO8	L2
e	Experiences	-	-
1			
2			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs C	Code:	15ME554	75 minutes							
Cour	se:	Non Traditio	onal Machir	ning			·			
•	-	Note: Answ	Marks	CO	Level					
1	a	Explain with EDM	in 8	CO7	L2					
	b	xplain with and also me		ess, 7	CO7	L2				
					OR					
2	a	What are the basic requirements of the dielectric fluid used in EDM						7	CO7	L2
	b	With the help of neat sketch, explain wire cut electrical discharge machining								L2
3	a	With a near			Plasma arc mac	hining (PA	AM) process and a	lso 8	CO8	L2
	b	Which are th	ne importan	t considerat	ions are to be ma	ade in the o	design of plasma tor	ch 7	CO8	L2
					OR					
4	a	Mention any	two advan	tages and d	isadvantages of p	olasma arc	machining	8	CO8	L2
	b	Explain the	basic princi	pal of PAM				7	CO8	L2

b. Assignment – 2

				N	Model Assignmen	t Question	1S			
Crs Co	ode:	15ME554	Sem:	5	Marks:	5 /	Time:	90 – 120 mi	nutes	
Course	ourse: Non Traditional Machining									
Note:	Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.									
SNo	USN			Assi	ignment Descrip	tion		Marks	CO	Level
1		Discuss t	he factors in	nfluencing	the choice of elec	trode mat	erial in EDM	5	CO7	L2
2		Explain v EDM	with help of	a neat ske	tches any two typ	oes of flus	hing methods used i	n 5	CO7	L2
3		Explain with help of neat sketches the mechanisms of metal removal in EDI process, and also mention its advantages and disadvantages							CO7	L2
4		Name some of the dielectric fluids commonly used in EDM. Name some of the tool material used in EDM							CO7	L2
5		What are	the basic re	quirement	s of the dielectric	fluid used	l in EDM	5	CO7	L2
6		With the	help of neat	sketch, ex	plain wire cut ele	ectrical dis	charge machining	5	CO7	L2
7			With a neat sketch explain the Plasma arc machining (PAM) process and als mention its applications						CO8	L2
8		Which are the important considerations are to be made in the design of plasmatorch						a 5	CO8	L2
9		Mention	any two adv	antages ar	nd disadvantages	of plasma	arc machining	5	CO8	L2
10		Explain t	he basic pri	ncipal of P	'AM			5	CO8	L2
11		Write the	application	of plasma	arc machining		·	5	CO8	L2
12		Discuss t	he factors in	nfluencing	the choice of elec	trode mat	erial in EDM	5	CO7	L2

13	Explain with help of a neat sketches any two types of flushing methods used in EDM	5	CO7	L2
14	Explain with help of neat sketches the mechanisms of metal removal in EDM process, and also mention its advantages and disadvantages	5	CO7	L2
15	Name some of the dielectric fluids commonly used in EDM. Name some of the tool material used in EDM	5	CO7	L2
16	What are the basic requirements of the dielectric fluid used in EDM	5	CO7	L2
17	With the help of neat sketch, explain wire cut electrical discharge machining	5	CO7	L2
18	With a neat sketch explain the Plasma arc machining (PAM) process and also mention its applications	5	CO8	L2
19	Which are the important considerations are to be made in the design of plasma torch	5	CO8	L2
20	Mention any two advantages and disadvantages of plasma arc machining	5	CO8	L2
21	Explain the basic principal of PAM	5	CO8	L2
22	Write the application of plasma arc machining	5	CO8	L2
23	Discuss the factors influencing the choice of electrode material in EDM	5	CO7	L2
24	Explain with help of a neat sketches any two types of flushing methods used in EDM	5	CO7	L2
25	Explain with help of neat sketches the mechanisms of metal removal in EDM process, and also mention its advantages and disadvantages	5	CO7	L2
26	Name some of the dielectric fluids commonly used in EDM. Name some of the tool material used in EDM	5	CO7	L2
27	What are the basic requirements of the dielectric fluid used in EDM	5	CO7	L2
28	With the help of neat sketch, explain wire cut electrical discharge machining	5	CO7	L2
29	With a neat sketch explain the Plasma arc machining (PAM) process and also mention its applications	5	CO8	L2
30	Which are the important considerations are to be made in the design of plasma torch	5	CO8	L2
31	Mention any two advantages and disadvantages of plasma arc machining	5	CO8	L2
32	Explain the basic principal of PAM	5	CO8	L2
33	Write the application of plasma arc machining	5	CO8	L2
34	Discuss the factors influencing the choice of electrode material in EDM	5	CO7	L2
35	Explain with help of a neat sketches any two types of flushing methods used in EDM	5	CO7	L2
37	Name some of the dielectric fluids commonly used in EDM. Name some of the tool material used in EDM	5	CO7	L2
38	What are the basic requirements of the dielectric fluid used in EDM	5	CO7	L2
39	With the help of neat sketch, explain wire cut electrical discharge machining	5	CO7	L2
40	With a neat sketch explain the Plasma arc machining (PAM) process and also mention its applications	5	CO8	L2
41	Which are the important considerations are to be made in the design of plasma torch	5	CO8	L2
42	Mention any two advantages and disadvantages of plasma arc machining	5	CO8	L2
43	Explain the basic principal of PAM	5	CO8	L2
44	Write the application of plasma arc machining	5	CO8	L2
45	Discuss the factors influencing the choice of electrode material in EDM	5	CO7	L2
46	Explain with help of a neat sketches any two types of flushing methods used in EDM	5	CO7	L2
47	Explain with help of neat sketches the mechanisms of metal removal in EDM process, and also mention its advantages and disadvantages	5	CO7	L2

D3. TEACHING PLAN - 3

Title:	Costing and depreciation	Appr Time:	10 Hrs
a	Course Outcomes	-	Blooms

_	The student should be able to:	-	Level
1	understand constructional features and performance of LBM.	CO9	L2
2	understand constructional features and performance of EBM.	CO10	L2
b	Course Schedule		
	Module Content Covered	CO	Level
1	LASER BEAM MACHINING (LBM)Introduction, generation of LASER,	CO9	L2
2	Equipment and mechanism of metal removal,	CO9	L2
3	LBM Parameters and characteristics,	CO9	L2
4	Applications, Advantages &limitations.	CO9	L2
5	ELECTRON BEAM MACHINING (EBM)Introduction,	CO10	L2
6	Principle, equipment.	CO10	L2
7	Mechanism of metal removal,	CO10	L2
8	Applications advantages and limitations.	CO10	L2
	Application Areas		
1	Welding of material.	CO10	L2
2	Finishing Injector nozzle of diesel engine.	CO10	L2
d	Review Questions		L2
1	With a neat sketch, explain the mechanism of metal removal in LBM	CO9	L2
	process.		
2	list out the commonly used gasses in LBM.	CO9	L2
3	What are the advantages and application of LBM.	CO9	L2
4	Explain typical laser system adopted for machining processes.	CO9	L2
5	Explain how the electron beam is generated in EBM process.	CO10	L2
6	What are the important characteristics required for electron beam in	CO10	L2
	electron beam machining.		
7	Explain with a neat sketch, EBM and list out its advantages.	CO10	L2
8	State the advantages and application of EBM.	CO10	L2
9	Write the application of EBM.	CO10	L2
e	Experiences	-	-
1			

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs (Code:	15ME554	Sem:	V	Marks:	Time:	5 minutes		
Cour	se:	Non Traditio	nal Machin	ing					
-	-	Note: Answe	er any 2 qu	estions, ea	ch carry equal marks	5.	Marks	CO	Level
1	a	With a neat s	ketch, expl	ain the med	chanism of metal remo	val in LBM process.	8	CO9	L2
	b	list out the co	ommonly u	sed glasses	in LBM.		7	CO9	L2
2	a	What are the	7	CO9	L2				
	b	Explain typic	xplain typical laser system adopted for machining processes.						
3	a	What are the important characteristics required for electron beam in electron beam machining.						CO10	L2
	b	Explain with	a neat sket	ch, EBM a	nd list out its advantage	es.	7	CO10	L2
					OR				
4	a	State the adv	antages and	l applicatio	n of EBM.		8	CO10	L2
	b	Write the app	rite the application and disadvantages of EBM.						

b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions

	COURSE PLAN - CAY 2019-20	E-8-ME-SI	ZI 1-E1120 I	-1 UZ- V Z
Crs Code		– 120 n	ninutes	
Course:	Non Traditional Machining			
SNo	h student to answer 2-3 assignments. Each assignment carries equal mark. USN Assignment Description	Marks	CO	Leve
1	With a neat sketch, explain the mechanism of metal removal in LBM	5	CO9	Leve L2
•	process.	5	00)	22
2	list out the commonly used gasses in LBM.	5	CO9	L2
3	What are the advantages and application of LBM.	5	CO9	L2
4	Explain typical laser system adopted for machining processes.	5	CO9	L2
5	Explain how the electron beam is generated in EBM process.	5	CO10	L2
6	What are the important characteristics required for electron beam in	5	CO10	L2
	electron beam machining.			
7	Explain with a neat sketch, EBM and list out its advantages.	5	CO10	L2
9	State the advantages and application of EBM.	5	CO10	L2
10	Write the application of EBM. With a neat sketch, explain the mechanism of metal removal in LBM	5	CO10 CO9	L2 L2
	process.			
12	What are the advantages and application of LBM.	5	CO9	L2
13	Explain typical laser system adopted for machining processes.	5	CO9	L2
14	Explain how the electron beam is generated in EBM process.	5	CO10	L2
15	What are the important characteristics required for electron beam in electron beam machining.	5	CO10	L2
16	Explain with a neat sketch, EBM and list out its advantages.	5	CO10	L2
17	State the advantages and application of EBM.	5	CO10	L2
18	Write the application of EBM.	5	CO10	L2
19	With a neat sketch, explain the mechanism of metal removal in LBM process.	5	CO9	L2
20	list out the commonly used gasses in LBM.	5	CO9	L2
21	What are the advantages and application of LBM.	5	CO9	L2
22	Explain typical laser system adopted for machining processes.	5	CO9	L2
23	Explain how the electron beam is generated in EBM process.	5	CO10	L2
24	What are the important characteristics required for electron beam in electron beam machining.	5	CO10	L2
25	Explain with a neat sketch, EBM and list out its advantages.	5	CO10	L2
26	State the advantages and application of EBM.	5	CO10	L2
28	With a neat sketch, explain the mechanism of metal removal in LBM process.	5	CO9	L2
29	list out the commonly used gasses in LBM.	5	CO9	L2
30	What are the advantages and application of LBM.	5	CO9	L2
31	Explain typical laser system adopted for machining processes.	5	CO9	L2
32 33	Explain how the electron beam is generated in EBM process. What are the important characteristics required for electron beam in	5	CO10	L2 L2
34	electron beam machining. Explain with a neat sketch, EBM and list out its advantages.	5	CO10	L2
35	State the advantages and application of EBM.	5	CO10	L2
36	Write the application of EBM.	5	CO10	L2
37	With a neat sketch, explain the mechanism of metal removal in LBM process.	5	CO9	L2
38	list out the commonly used gasses in LBM.	5	CO9	L2
39	What are the advantages and application of LBM.	5	CO9	L2
40	Explain typical laser system adopted for machining processes.	5	CO9	L2
41	Explain how the electron beam is generated in EBM process.	5	CO10	L2
42	What are the important characteristics required for electron beam in electron beam machining.	5	CO10	L2
43	Explain with a neat sketch, EBM and list out its advantages.	5	CO10	L2
44	State the advantages and application of EBM.	5	CO10	L2
	With a neat sketch, explain the mechanism of metal removal in LBM	5	CO9	L2

F. EXAM PREPARATION

1. University Model Question Paper

Course:		Non Traditional Machining Month			ar	M /2018	
Crs C	Code:	15ME554 Sem: v Marl	Time:		180 mir	nutes	
	Note	Answer all FIVE full questions. All questions carry		\mathbf{M}	Iarks	CO	Level
1	a	Define and Classify Non –Traditional machining pro			6	CO1	L2
	b	Explain the need of Non –Traditional machining pro			5	CO1	L2
	С	List the advantages and disadvantages of Non –Trad OR	itional machining proc	ess.	5	CO1	L2
-	a	Enumerate the physical parameters of the Non-Trad	itional machining proc	ess	6	CO1	L2
	b	Discuss the process capability of any two Non -Trac	litional machining proc	ess.	5	CO1	L2
	С	Differentiate Traditional and Non –Traditional mach		5	CO1	L2	
2	a	Sketch and explain Ultrasonic machining process.			6	C02	L2
	b	Explain the influence of various process parameters	on MRR in USM.		5		L2
	С	Explain, how does abrasive jet machining differ from process?	n conventional sand bla	asting	5	C02	L2
-	a	What are the different types of abrasives used in AJI			6	CO3	L2
	b	With neat sketch explain the working principle of Al	orasive Jet machining p	rocess.	5	CO3	L2
	c	With the help of neat sketch explain Water Jet Mach			5	CO4 CO5	L2
3	 a Explain different elements of electro chemical machining process. b Sketch and explain the electro chemical grinding operation. c With neat sketch, explain the working principle of ECM process. 						L2
							L2
	С		5	CO5	L2		
	d						
		OR					
-	a	Sketch and explain different steps involved in the ch		ess.	6	CO6	L2
	b	Explain in brief the following in chemical machining i) Maskants, ii) Etchants		5	CO6	L2	
	С	List the advantages, limitations and applications of oprocess.		5	CO6	L2	
		Process.					
4	a	Sketch and explain the electrode feed control used in	EDM process.		6	CO7	L2
	b	Explain with sketch the travelling wire EDM proces	S.		5	CO7	L2
	С	Sketch and explain various die electric flow patterns	of EDM process		5	CO7	L2
		OR					
-	a	Explain with sketch the principle of working of plas	ma arc machining proc	ess.	8	CO8	L2
	b	List the safety precautions, advantages, limitations a			8	CO8	L2
		PAM process	Tr				
5	a	Sketch and explain Laser beam machining process.			6	CO9	L2
	b	Discuss various process parameters of LBM process			5	CO9	L2
	С	List the advantages, limitations and applications of I	LBM process.		5	CO9	L2
		OR					
	a	Explain with sketch the principle of working of Elec	rocess.	6	CO10	L2	
	b	State the advantages and limitations of EBM process	3		5	CO10	L2
	С	Describe the apparatus used to generate the Laser.			5	C010	L2

2. SEE Important Questions

Course	Course: Non Traditional Machining Month					n / Year May /2018		018		
Crs Code:		15ME554	Sem:	V	Marks:	80	Time:		180 minutes	
	Note	Answer all FIV	E full questic	ns. All question	s carry equal m	narks.		-	-	
Modul Qno. Important Question								Marks	CO	Year

e					1
1	1	Differentiate between conventional and Non-conventional manufacturing process.	5	C01	2015
	2	List and explain the various factors to be considered for selection of machining processes.	6	C01	2015
	3	Explain how the non- conventional machining processes are classified.	6	C01	2016
	4	List and explain the various factors to be considered for selection of machining processes .	5	C01	2016
	5	Make a comparison between traditional and non- traditional machining process in terms of cost ,application, scope, machine time and limitations.	5	C01	2017
2	1	Explain with neat diagram construction and working of USM processes.	5	C02	2014
	2	Explain with graph the effect of various parameters on material removal rate in USM process.	6	C02	2016
	3	Explain with neat diagram construction and working of AJM processes.	5	C03	2015
	4	Explain with neat diagram construction and working of WJM processes.	8	C04	2017
	5	Mention the advantages and disadvantages of WJM	5	C04	2016
3	1	Why electro chemical machining considered as chip less machining? Explain the mechanisms of metal removal on both cases and compare it with conventional grinding process	8	C05	2016
	2	With suitable sketches, explain the material removal mechanisms in electro chemical grinding	5	C05	2015
	3	Explain the principle of electro chemical grinding, with neat sketch	6	C05	2016
	4	List out major applications of CHM. Further process application related to improving the surface characteristics	7	C06	2017
	5	Explain the principle steps involved in chemical milling to produce pockets and contours .	7	C06	2016
4	1	Explain with help of a neat sketches any two types of flushing methods used in EDM.	7	C07	2015
	2	What are the basic requirements of the dielectric fluid used in EDM	6	C07	2014
	3	With the help of neat sketch, explain wire cut electrical discharge machining	5	C07	2016
	4	Explain the basic principal of PAM	5	C08	2015
	5	Which are the important considerations are to be made in the design of plasma torch	6	C08	2017
5	1	With a neat sketch, explain the mechanism of metal removal in LBM process. What are the advantages and application of LBM.	7	C09	2016
	2	Explain typical laser system adopted for machining processes.	5	C09	2017
	3	Explain how the electron beam is generated in EBM process.	5	C010	2016
	4	What are the important characteristics required for electron beam in electron beam machining.	6	C010	2015
	5	Explain with a neat sketch, EBM and list out its advantages.	5	C010	2016

G. Content to Course Outcomes

1. TLPA Parameters

<u>Table 1: TLPA – Example Course</u>

Mo	Course Content or Syllabus	Content	Blooms'	Final	Identified	Instructio	Assessment
dul	(Split module content into 2 parts which have	Teaching	Learning	Bloo	Action	n	Methods to
e-#	similar concepts)	Hours	Levels for	ms'	Verbs for	Methods	Measure
			Content	Level	Learning	for	Learning
						Learning	

\boldsymbol{A}	В	C	D	\boldsymbol{E}	F	\boldsymbol{G}	H
1	Introduction to Non-traditional	8	- L1	L2	Understd	Lecture/T	Assignment
	machining:Need for Non-traditional machining		- L2		the	utorial	
	process, Comparison between traditional and				concept of NTM		
	non-traditional machining, general				process		
	classification Nontraditional machining				process		
	processes, classification based on nature of						
	energy employed in machining, selection of non-						
	traditional machining processes, Specific						
	advantages, limitations and applications of non-						
2	traditional machining processes. Ultrasonic Machining (USM): Introduction,	4	- L1	L2	I Indoneti IC	L a atuma /T	Assisanment
2	Ultrasonic Machining (USM): Introduction, Equipment and material process, Effect of process	4	- L1 - L2	L2	UnderstUS M	utorial	Assignment
	parameters: Effect of amplitude and frequency,				Machining		
	Effect of abrasive grain diameter, effect of slurry,						
	tool &work material. Process characteristics:						
	Material removal rate, tool wear, accuracy, surface						
	finish, applications, advantages &limitations of USM						
2	Abrasive Jet Machining (AJM): Introduction,	2	- L1	L2	UnderstAI	Lecture/T	Assignment
-	Equipment and process of material	_	- L2		M	utorial	
	removal,process variables: carrier gas, type of				Machining		
	abrasive, work material, stand-off						
	distance(SOD).Process characteristics-Material						
	removal rate, Nozzle wear, accuracy &surface						
	finish. Applications, advantages &limitations of						
	AJM.						
2	Water Jet Machining (WJM): Equipment	2	- L1	L2	UnderstW		Assignment
	&process, Operation, applications, advantages		- L2		JM Machining	utorial	
2	and limitations of WJM.	~	T 1	T 0	Machining		A •
3	Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM	5	- L1 - L2	L2	UnderstEC M	utorial	Assignment
	Operation, Chemistry of ECM. ECM Process		- L2		Machining		
	characteristics: Material removal rate, accuracy,				8		
	Surface finish. Process parameters: Current density,						
	Tool feed rate, Gap between tool &work piece,						
	velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of						
	Electrolytes. ECM Tooling: ECM tooling technique						
	&example, Tool &insulation materials. Applications						
	ECM: Electrochemical grinding and electrochemical						
	honing process. Advantages, disadvantages and						
2	application of ECM.		T 1	1.2	IIn danie	Looter /T	A ani
3	CHM Elements of the process: Resists (maskants), Etchants. Types of chemical machining process	5	- L1 - L2	L2	HM	Lecture/T utorial	Assignment
	chemical Blanking process, chemical milling		112		Machining		
	process. Process characteristics of CHM: material						
	removal rate, accuracy, surface finish, advantages,						
	limitations and applications of chemical machining						
4	process. Introduction, mechanism of metal removal, EDM	4	- L1	L2	UnderstF	Lecture/T	Assignment
*	equipment: spark erosion generator (Relaxation	•	- L1 - L2		DM	utorial	. 10015IIIIICIII
	type), dielectric medium-its functions &desirable				Machining		
	properties, electrode feed control system. Flushing						
	types; pressure flushing, suction flushing, side						
	flushing, pulsed flushing. EDM process parameters:						
	Spark frequency, current &spark gap, surface finish,						
	Heat Affected Zone. Advantages, limitations						
	&applications of EDM, Electrical discharge						

	grinding, Traveling wire EDM.						
4	PLASMA ARC MACHINING (PAM)	5	- L1	L2	UnderstPA	Lecture/T	Assignment
	Introduction, non-thermal generation of plasma,		- L2		M	utorial	
	equipment mechanism of metal removal, Plasma				Machining		
	torch, process parameters, process characteristics.						
	Safety precautions. Safety Precautions, applications,						
	advantages and limitations.						
5	LASER BEAM MACHINING (LBM)	4	- L1	L2	UnderstlL	Lecture/T	Assignment
	Introduction, generation of LASER, Equipment and		- L2		BM	utorial	
	mechanism of metal removal, LBM Parameters and				Machining		
	characteristics, Applications, Advantages						
	&limitations.						
5	ELECTRON BEAM MACHINING (EBM)	4	- L1	L2	UnderstEB	Lecture/T	Assignment
	Introduction, Principle, equipment and mechanism		- L2		M	utorial	
	of metal removal, applications,				Machining		
	advantages and limitations.						

2. Concepts and Outcomes:

<u>Table 2: Concept to Outcome – Example Course</u>

			1	_		T
Mo	Learning or	Identified	Final Concept	Concept Justification	CO Components	Course Outcome
dul	Outcome from	Concepts		(What all Learning	(1.Action Verb,	
e-#	study of the	from		Happened from the	2.Knowledge,	
	Content or	Content		study of Content /	3.Condition /	Student Should be
	Syllabus			Syllabus. A short word		able to
				for learning or	4.Benchmark)	
				outcome)		
\boldsymbol{A}	I	J	K	L	M	N
1	-	-		field of Product Life	- Understand	Understand the field of
	-	-	cycle model	cycle model		Product Life cycle
					cycle model	model
1	-	-	Product Data	the Product data	- Understand	Understand the Product
	-	-		management	-the Product data	data management
					management	
2	-	_	Product design		- Understand	Understand the process
	-	-	and Planning	planning and design of	- the process of	of planning and design
				product model	planning and design of	of product model
					product model	
2	-	=	selection	Recycling and	- Understand	Understand the
	-	-	techniques for	simulation for PDM		knowledge for
			PDM	Techniques	simulation for PDM	selecting the techniques
					Techniques	to recycling and
						simulation for PDM
3	-	=	Production	new product	- Understand	Understand the concept
	-	-	Control	development through	 new product 	of new product
			techniques	controlled techniques	development through	development through
					controlled techniques	controlled techniques
3	-	=	new product	structure of the new	- Understand	Understand a concept
	-	-	Building	product to build	- structure of the new	of structure of the new
					product to build	product to build
4	-	-	development	product development	- Understand	Understand techniques
	-	-	approaches	approaches	- product development	of product development
					approaches	approaches
4	-	-	Methods and	different methods and	- Understand	Understand different
	-	-	tools of	tools of Forecasting	- different methods and	methods and tools of
			Forecasting		tools of Forecasting	Forecasting innovations
					innovations	_
5	-	-	Product	product building	- Understand	Understand the product
				-		-

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	- -	configurations	configurations	 product building 	configurations to build
				configurations	new product
5		Product	analysis of product	- Understand	Understand the analysis
		Structure	structure	 analysis of product 	of product structure
				structure	