

Dof	No
Ref	INO:

Sri krishna Institute of Technology, Bangalore



COURSE PLAN

Academic Year 2019-2020

Program:	B E – Mechanical Engineering
Semester :	8
Course Code:	15ME82
Course Title:	Adittive Manufacturing
Credit / L-T-P:	4 / 4-0-0
Total Contact Hours:	50
Course Plan Author:	Mr.PRAMOD S N / Mr.SHANKAREGOWDA K C

Academic Evaluation and Monitoring Cell

#29, Hesaraghatta Main road, Chimney Hills, Chikkabanavara P.O., Bengaluru – 560090, Karnataka, INDIA Phone / Fax :+91 80 23721477 -STD- 080 23721315 Web:www.skit.org.in E-mail:skit1princi@gmail.com/principal@skit.org.in

AN INSTITUTE OF IT	SKIT	Teaching Process	Rev No.: 1.0
Participanti and a second seco	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
St BANGALORE *	Title:	Course Plan	Page: 2 / 22

Copyright ©2017. cAAS. All rights reserved. Table of Contents

15ME82 : ADDITIVE MANUFACTURING	
A. COURSE INFORMATION	
1. Course Overview	
2. Course Content	
3. Course Material	
4. Course Prerequisites	
B. OBE PARAMETERS	
1. Course Outcomes	
2. Course Applications	
3. Articulation Matrix	
4. Mapping Justification	
5. Curricular Gap and Content	
6. Content Beyond Syllabus C. COURSE ASSESSMENT	
1. Course Coverage	
2. Continuous Internal Assessment (CIA)	
D1. TEACHING PLAN - 1	
DI. TEACHING FEAN - 1 Module - 1	
Module - 2	
E1. CIA EXAM – 1	
a. Model Question Paper - 1	•
b. Assignment -1	
D2. TEACHING PLAN - 2	
Module – 3	
Module – 4	
E2. CIA EXAM – 2	
a. Model Question Paper - 2	
b. Assignment – 2	
D3. TEACHING PLAN - 3	
Module – 5	
E3. CIA EXAM – 3	
a. Model Question Paper - 3	
b. Assignment – 3	-
F. EXAM PREPARATION	
1. University Model Question Paper	
2. SEE Important Questions	

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

15ME82 : ADDITIVE MANUFACTURING

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	ME
Year / Semester :	4/VIII	Academic Year:	2019-2020
Course Title:	Additive Manufacturing	Course Code:	15ME82
Credit / L-T-P:	4/4-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	50	SEE Marks:	80Marks
CIA Marks:	20	Assignment	1 / Module
Course Plan Author:	Mr. SHANKAREGOWDA K C	Sign	Dt:
Checked By:	Mr. PRAMOD S N	Sign	Dt:

2. Course Content

Modu	Module Content	Teaching	Module	Blooms
le		Hours	Concepts	Level
1	Introduction to Additive Manufacturing: Introduction to AM, AM evolution,Distinction between AM & CNC machining, Advantages of AM, AM process chain:Conceptualization, CAD, conversion to STL, Transfer to AM, STL file manipulation, Machine setup, build, removal and clean up, post processing. Classification of AM processes: Liquid polymer system,Discrete particle system,Molten material systems and Solid sheet system.Post processing of AM parts: Support mterial removal, surface texture improvement,accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques. Guidelines for process selection: Introduction, selection MM Applications: Functional models, Pattern for investment and vacuum casting,Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Aerospace,defence, automobile, Bio-medical and general engineering industries	10	Additive manufacturing	L1,L2
2	System Drives and devices: Hydraulic and pneumatic motors and their features,Electrical motors AC/DC and their featuresActuators: Electrical Actuators; Solenoids, Relays, Diodes, Thyristors, Triacs, Hydraulicand Pneumatic actuators, Design of Hydraulic and Pneumatic circuits, Piezoelectricactuators, Shape memory alloys. POLYMERS & POWDER METALLURGY	08	Drives and Actuators Material	L2,L3
5	Basic Concepts: Introduction to Polymers used for additive manufacturing: polyamide,PF resin, polyesters etc. Classification of polymers, Concept of functionality, HoursPolydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD]Polymer Processing: Methods of spinning for additive manufacturing: Wet spinning,Dry spinning. Biopolymers, Compatibility issues with polymers. Moulding and casting ofpolymers, Polymer processing techniquesGeneral Concepts: Introduction and History of Powder Metallurgy (PM), Present andFuture Trends of PMPowder Production		processing	

ANSTITUTE OF A	SKIT	Teaching Process	Rev No.: 1.0
POLONH	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
Stangalone *	Title:	Course Plan	Page: 4 / 22

Copyrigh	t ©2017. cAAS. All rights reserved.			
	Techniques:Different Mechanical and Chemical methods,Atomisation of Powder, other emergingprocesses.Characterization Techniques:Particle Size & Shape Distribution, Electron Microscopy of Powder,			
	InterparticleFriction, Compression ability, Powder Structure, Chemical CharacterizationMicrostructure Control in Powder:			
	Importance of Microstructure Study, Microstructures of Powder by Different techniquesPowder Shaping: Particle Packing			
	Modifications, Lubricants & Binders, PowderCompaction & Process Variables, Pressure & Density Distribution during			
	Compaction,Isotactic Pressing, Injection Moulding, Powder Extrusion, Slip Casting, Tape Casting.Sintering: Theory of			
	Sintering, Sintering of Single & Mixed Phase Powder, Liquid PhaseSintering Modern Sintering Techniques, Physical &			
	Mechanical Properties Evaluation, Structure-Property Correlation Study, Modern Sintering techniques, Defects			
	Analysis ofSintered ComponentsApplication of Powder Metallurgy: Filters, Tungsten Filaments, Self-			
4	LubricatingBearings, Porous Materials, Biomaterials etc. NANO MATERIALS & CHARACTERIZATION TECHNIQUES:	10	Nano concept	L2,L3
	Introduction: Importance of Nano-technology, Emergence of			
	Nanotechnology, Bottom-up and Top-down approaches, challenges in NanotechnologyNano-materials Synthesis and			
	Processing: Methods forcreating Nanostructures; Processes for			
	producing ultrafine powders- Mechanical grinding; Wet			
	ChemicalSynthesis of Nano-materials- sol-gel process; Gas			
	Phase synthesis of Nano-materials-Furnace, Flame assisted ultrasonic spray pyrolysis; Gas Condensation Processing			
	(GPC),Chemical Vapour Condensation(CVC).Optical Microscopy			
	- principles, Imaging Modes, Applications, Limitations.Scanning			
	Electron Microscopy (SEM) - principles, Imaging Modes,			
	Applications, Limitations. Transmission Electron Microscopy			
	(TEM) - principles, Imaging Modes, Applications, Limitations.X- Ray Diffraction (XRD) - principles, Imaging Modes, Applications,			
	Limitations.Scanning Probe Microscopy (SPM) - principles,			
	ImagingModes, Applications, Limitations.Atomic Force			
	Microscopy (AFM) - basic principles,instrumentation,			
	operational modes, Applications, Limitations. Electron Probe			
	MicroAnalyzer (EPMA) - Introduction, Sample preparation, Working procedure, Applications, Limitations.			
5	MANUFACTURING CONTROL AND AUTOMATION	10	Automation	L2,L3
	CNC technology - An overview: Introduction to NC/CNC/DNC			-
	machine tools, Classification of NC /CNC machine tools,			
	Advantage, disadvantages of NC /CNC			
	machine tools, Application of NC/CNC Part programming: CNC programming and introduction, Manual part programming:			
	Basic (Drilling, milling, turning etc.), Specialpart programming,			
	Advanced part programming, Computer aided part			
	programming(APT)Introduction: Automation in production			
	system principles and strategies of automation, basic Elements			
	of an automated system. Advanced Automation functions. Levels ofAutomations, introduction to automation			
	productivityControl Technologies in Automation: Industrial			
	control system. Process industry vsdiscrete manufacturing			
	industries. Continuous vs discrete control. Continuous			

ANNSTITUTE OF THE	SKIT	Teaching Process	Rev No.: 1.0
(IN IN I	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
Sh BANGALORE	Title:	Course Plan	Page: 5 / 22

Copyright	©2017. cAAS. All rights reserved.		
	processand its forms. Other control system components		

3. Course Material

Module	Details	Available
	Reference books	
1	Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles &	In Lib,In dept lib
	Applications", World Scientific, 2003.	
2	G Odian Principles of Polymerization, Wiley Inerscience John Wiley and Sons, 4th edition, 2005	In Lib,In dept lib
3	Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press,	In Lib,In dept lib
	2005.	
	Reference books	
	Powder Metallurgy Technology, Cambridge International Science	In Lib,In dept lib
	Publishing, 2002.	
5	P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology	In Lib,In dept lib
	and Applications, PHI, New Delhi, 2008.	
	Mikell P Groover, Automation, Production Systems and Computer	In Lib,In dept lib
	Integrated Manufacturing, 3rd Edition, Prentice Hall Inc., New Delhi, 2007	
	Others (Web, Video, Simulation, Notes etc.)	
	https://www.youtube.com/watch?v=kKQ5KwFwW_s	
	https://www.youtube.com/watch?v=_mhN1d768o8	
	https://www.youtube.com/watch?v=bopz6b3-CTU	

4. Course Prerequisites

SN	Course	Course Name	Module / Topic / Description	Sem	Remarks	Blooms
0	Code					Level
1	15ME62	Computer	MANUFACTURING CONTROL AND	6		L2
		integrated	AUTOMATION			
		manufacturing				
2	15ME72	Fluid power	System Drives and devices	7		L2
		system				

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

B. OBE PARAMETERS

1. Course Outcomes

#	COs	Teach.	Concept	Instr	Assessment	Blooms'
		Hours		Method	Method	Level
15ME8	Student should able to understand	10	Additive	Chalk	Assignment ,	L2
2.1	Concept of additive manufacturing and		manufacturing	and	Unit test and	Underst
	post processing of AM			board	CIA	and
15ME8	Student should able to u nderstand	08	Drives	Chalk	Assignment ,	L2
	Systems of drives, actuators and its			and	Unit test and	Underst
	types.			board	CIA	and
15ME8	Student should able to understand	12	Micro structure	Chalk	Assignment ,	L2
2.3	power metallurgy technique and micro			and	Unit test and	Underst
	structure of power in various methods.			board	CIA	and
15ME8	Student should able to understand	10	Nano	Chalk	Assignment ,	L2

AN INSTITUTE OF A	SKIT	Teaching Process	Rev No.: 1.0
(IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
BANGALORE*	Title:	Course Plan	Page: 6 / 22
Copyright ©2017 cA	AS All rights reserved		

		-								
-	Total	50	-	-	-	-				
				board	CIA	and				
2.5	automation and control techniques.			and	Unit test and	Underst				
15ME	Student should able to understand	10	Automation	Chalk	Assignment ,	L2				
	microscopy.			board	CIA	and				
2.4	Concept of nano technology and optical		technology	and	Unit test and	Underst				
Copyright	Copyright ©2017. cAAS. All rights reserved.									

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

2. Course Applications

SNo	Application Area	CO	Level
1	Manufacturing.	CO1	L2
2	Drivers and actuators,CNC.	CO1	L2
3	Material processing.	CO3	L2
4	Nano technology	CO2	L2
5	Automation	CO3	L2
Mata	Write 1 or 2 applications por CO		

Note: Write 1 or 2 applications per CO.

3. Articulation Matrix

(CO – PO MAPPING)

-	Course Outcomes	Program Outcomes												
#	COs	PO1	PO2	PO ₃	PO4	PO5	PO	PO7	PO8	PO9	PO1	PO1	PO1	Level
							6				0	1	2	
0	Student should able to understand Concept of additive manufacturing and post processing of AM	-	-	-	-	-	-	-	-	-	-	-	-	L2
15ME82.2	Student should able to understand Systems of drives, actuators and its types.	-	-	-	-	-	-	-	-	-	-	-	-	L2
15ME82.3	Student should able to understand power metallurgy technique and micro structure of power in various methods.	V	-	-	-	-	-	-	-	-	-	-	-	L2
15ME82.4	Student should able to understand Concept of nano technology and optical microscopy.		-	-	-	-	-	-	-	-	-	-	-	L2
15ME82.5	Student should able to understand automation and control techniques.	-	-	-	-	-	-	-	-	-	-	-	-	L2
lote: Menti	on the mapping strength as 1, 2,	or 3												

4. Mapping Justification

Mapping		Justification	Mapping Level
СО	PO		-
CO1	PO1	Apply the knowledge of additive manufacturing	L2
CO1	PO2	Since it is basic science -No mapping	L2

ASTITUTE OF A	SKIT	Teaching Process	Rev No.: 1.0
(All Constructions)	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
#BANGALORE*	Title:	Course Plan	Page: 7 / 22

	AS. All rights reserved					
CO1	PO3	Atudents will not be Designing/developing of solution-No mapping	L2			
CO1	PO4	Since no conduction on investigations of complex Problems-No mapping	L2			
CO1	PO5	No Modern tools are used -No mapping	L2			
CO1	P06	No inpact on engineers and society-No mapping	L2			
CO1	P00	ill not be affected on environment and sustainability-No mapping				
CO1	P07	Since the study is limited to basics -No mapping	L2 L2			
CO1						
	PO9	Will not be working either Individual nor team work-No mapping	L2			
CO1 CO1	PO10	NO instruction will be given -No mapping	L2			
	PO11	No application of management and finance principles involved -No mapping	L2 			
CO1	PO12	Due to change in technology-No mapping				
CO2	PO1	Apply the knowledge of different AM processing	L2			
CO2	PO2	Since it is basic science -No mapping	L2			
CO2	PO3	Students will not be Designing/developing of solution-No mapping	 L2			
CO2	PO4	Since no conduction on investigations of complex Problems-No mapping	L2			
CO2	PO5	No Modern tools are used -No mapping	L2			
CO2	PO6	Impact on engineers and society through improved productivity and efficiency	L2			
CO2	PO7	Will not be affected on environment and sustainability-No mapping	L2			
CO2	PO8	Since the study is limited to basics -No mapping	L2			
CO2	PO9	Will not be working either Individual nor team work-No mapping	L2			
CO2	PO10	NO instruction will be given -No mapping	 L2			
CO2	PO11	No application of management and finance principles involved -No mapping	L2			
CO2	PO12	Due to change in technology-No mapping	L2			
CO3	PO1	Apply the knowledge of drives in machines	L2			
CO3	PO2	Since it is basic science -No mapping	 L2			
CO3	PO3	Students will not be Designing/developing of solution-No mapping	 L2			
CO3	PO4	Since no conduction on investigations of complex Problems-No mapping	L2			
CO3	PO5	No Modern tools are used -No mapping	L2			
CO3	PO6	Impact on engineers and society through improved productivity and efficiency	L2			
CO3	PO7	Will affect on environment and sustainability in utilizing resources	L2			
CO3	PO8	Since the study is limited to basics -No mapping	 L2			
CO3	PO9	Will not be working either Individual nor team work-No mapping	L2			
CO3	PO10	NO instruction will be given -No mapping	 L2			
CO3	PO11	No application of management and finance principles involved -No mapping	L2			
CO3	PO12	Due to change in technology-No mapping	L2			
CO4	PO1	Apply the knowledge of actuators in machines	L2			
CO4	PO2	Since it is basic science -No mapping	L2			
CO4	PO3	Students will not be Designing/developing of solution-No mapping	L2			
CO4	PO4	Since no conduction on investigations of complex Problems-No mapping	L2			
CO4	PO5	No Modern tools are used -No mapping	L2			
CO4	P06	Impact on engineers and society through improved driving mechanism	L2			
CO4	PO7	Will affect on environment and sustainability in automation	L2			
~~+	1 0/					

HINGLOOD CHARACTER OF THE OF T)
ES * BANGALORE*	/
HIGHLING C F)

SKIT	Teaching Process	Rev No.: 1.0
Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
Title:	Course Plan	Page: 8 / 22

Copyright ©2017. CAA	S. All rights reserve	ed.	
CO4	PO8	Since the study is limited to basics -No mapping	L2
CO4	PO9	Will not be working either Individual nor team work-No mapping	L2
CO4	PO10	NO instruction will be given -No mapping	L2
CO4	PO11	No application of management and finance principles involved -No	L2
	DOID	mapping	
CO4	PO12	Due to change in technology-No mapping	L2
CO5	PO1	To know the knowledge of polymers and powder metallurgy	L2
CO5	PO2	Since it is basic science -No mapping	L2
CO5	PO3	Students will not be Designing/developing of solution-No mapping	L2
CO5	PO4	Since no conduction on investigations of complex Problems-No	L2
		mapping	
CO5	PO5	Modern tools are used	L2
CO5	PO6	Impact on engineers and society through improved processing methods	L2
CO5	PO7	Will not be affected on environment and sustainability-No mapping	L2
CO5	PO8	Since the study is limited to basics -No mapping	L2
CO5	PO9	Will not be working either Individual nor team work-No mapping	L2
CO5	PO10	NO instruction will be given -No mapping	L2
CO5	PO11	No application of management and finance principles involved -No	L2
		mapping	
CO5	PO12	Due to change in technology-No mapping	L2

Note: Write justification for each CO-PO mapping.

5. Curricular Gap and Content

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					

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

6. Content Beyond Syllabus

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					

Note: Anything not covered above is included here.

C. COURSE ASSESSMENT

1. Course Coverage

Mod	Title	Teaching		No. of question in Exam					CO	Levels
ule		Hours	CIA-1	CIA-2	CIA-3	Asg	Extra	SEE		
#							Asg			
1	Introduction to additive	10	2	-	-		-	-	CO1,	L1, L2
	manufacturing					1			CO1	
2	System drives and actuators	08	2	-	-		-	-	CO3,	L1, L2
									CO2	
3	Polymers and metallurgy	12	-	2	-		-	-	CO3,	L1, L2
						1			CO3	
4	Nano materials	10	-	2	-		-	-	CO4,	L1, L2
									Co8	

AN INSTITUTE OF THE	SKIT	Teaching Process	Rev No.: 1.0
	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
BANGALORE*	Title:	Course Plan	Page: 9 / 22

-	Total	50	4	4	4	3	-	-	-	-
-	manufacturing	10				1			CO5	
5			-	-	4		-		CO5,	L1, L2

Note: Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

2. Continuous Internal Assessment (CIA)

Evaluation	Weightage in Marks	СО	Levels
CIA Exam – 1	15	CO1, CO1, CO3, CO2	L1,L2
CIA Exam – 2	15	CO3, CO3, CO4, C08	L1,L2
CIA Exam – 3	15	CO5,CO5	L1,L2
Assignment - 1	05	CO1, CO1, CO3, CO2	L1,L2
Assignment - 2	05	CO3, CO3, CO4, C08	L1,L2
Assignment - 3	05	CO5,CO5	L1,L2
Seminar - 1			
Other Activities – define –			
Slip test			
Final CIA Marks	20	-	-

Note : Blooms Level in last column shall match with A.2 above.

D1. TEACHING PLAN - 1

Module - 1

Title:	Introduction Additive Manufacturing	Appr Time:	10 Hrs
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Understand concept of additive manufacturing.	CO1	L2
2	Identify types, limitation and applications of AM.	CO1	L2
b	Course Schedule	-	-
Class No	Module Content Covered	СО	Level
1	Introduction to Additive Manufacturing: Introduction to AM, AM evolution.	C01	L2
2	Distinction between AM & CNC machining, Advantages of AM, AM process chain.	C01	L2
3	Conceptualization, CAD, conversion to STL, Transfer to AM, STL file manipulation.	C01	L2
4	Machine setup, build , removal and clean up, post processing.	C01	L2
5	Classification of AM processes: Liquid polymer system, Discrete particle system.	C01	L2
6	Property enhancements using non-thermal and thermal techniques.	C01	L2
7	accuracy improvement, aesthetic improvement, preparation for use as a pattern.	C01	L2
8	Post processing of AM parts: Support material removal, surface texture improvement.	C01	L2
9	Nolten material systems and Solid sheet system.	C01	L2
10	Application examples for Aerospace, defence, automobile, Bio-medical and general engineering industries.	C01	L2
с	Application Areas	со	Level
1	Manufacturing.	CO1	L2

AN INSTITUTE OF A	SKIT	Teaching Process	Rev No.: 1.0
POTOWH	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
BANGALORE*	Title:	Course Plan	Page: 10 / 22

2	Rapid prototyping.	CO1	L2
d	Review Questions	-	-
1	Define additive manufacturing. Explain the evolution of additive manufacturing.	CO1	L2
2	Distinguish between CNC and additive manufacturing.	CO1	L2
3	Give the classification OF additive manufacturing.	CO1	L2
4	Explain the guidelines of process selection.	CO1	L2
5	What are the prerequisites of post processing of additive manufactured parts.	CO1	L2
6	Explain liquid polymer system	CO1	L2
7	Explain with a neat sketch molten material system	CO1	L2
8	List the application of additive manufacturing	CO1	L2
9	What is do you mean by Re-manufacturing ?	CO1	L2
10	What do you mean by engineering analysis models?	CO1	L2
	Evertionees		
е	Experiences	-	-
1			
2			

Module – 2

module	2		
Title:	System drives and devices	Appr Time:	10 Hrs
a	Course Outcomes	_	Blooms
-	The student should be able to:	-	Level
1	Understand the various drives and its mechanism.	CO2	L2
2	Understand the different actuators,its types.	CO2	L2
b	Course Schedule	-	-
Class No	Module Content Covered	CO	Level
1	System Drives and devices: Hydraulic and pneumatic motors and their features.	CO2	L2
2	Electrical motors AC/DC and their features.	CO2	L2
3	Actuators: Electrical Actuators.	CO2	L2
4	Hydraulic and Pneumatic actuators.	CO2	L2
5	Design of Hydraulic and Pneumatic circuits.	CO2	L2
6	Piezoelectric actuators.	CO2	L2
7	Solenoids, Relays, Diodes, Thyristors, Triacs.	CO2	L2
8	Shape memory alloys.	CO2	L2
с	Application Areas	СО	Level
1	CNC.	CO2	L2
2	Automation.	CO2	L2
d	Review Questions		_
 1	What is the difference between hydraulics and pneumatic motors?	CO2	L2
2	What are the salient features of AC/DC motors?	CO2	L2
3	What do you mean by actuators?List the types of actuators	CO2	L2
4	Explain the working of thyristors and triacs ?	CO2	L2
5	What are the design parameters while building a hydraulics and	CO2	L2

ANSTITUTE OF IS	SKIT	Teaching Process	Rev No.: 1.0				
	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020				
BANGALORE*	Title:	Course Plan	Page: 11 / 22				
Copyright ©2017. CAAS. All rights reserved.							

ences	-	-
neat sketch relay and diode actuator.	CO2	L2
neat sketch solenoid actuator.	CO2	L2
ne classification of actuators.	CO2	L2
are the features of shape memory alloy?	CO2	L2
do you mean by piezoelectric materials actuators?	CO2	L2
natic circuit?		
<u> </u>	eserved. c circuit?	

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs (Code:	15ME82 Sem: VIII Marks: 15 Time: 75	minute	S	
Cou		Additive Manufacturing			
-	-	Note: Answer any 2 questions, each carry equal marks.	Marks	CO	Level
1	а	Define additive manufacturing. Explain the evolution of additive	5	CO1	L2
		manufacturing.			
	b	Distinguish between CNC and additive manufacturing.	6	CO1	L2
	С	Give the classification OF additive manufacturing.	4	CO1	L2
		OR			
2	а	Explain with a neat sketch molten material system	4	CO1	L2
	b	List the application of additive manufacturing	4	CO1	L2
	С	What is do you mean by Re-manufacturing ?	7	CO1	L2
3	а	Explain the working of thyristors and triacs ?	5	CO2	L2
		What are the design parameters while building a hydraulics and pneumatic circuit?		CO2	L2
	С	What do you mean by piezoelectric materials actuators?	4	CO2	L2
		OR			
4	а	What are the features of shape memory alloy?	5	CO2	L2
	b	Give the classification of actuators.	5	CO2	L2
	С	With a neat sketch solenoid actuator.	5	CO2	L2

b. Assignment -1

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

	Model Assignment Questions											
Crs Co	ode:	15ME82	2 Sem: VIII Marks: 5 Time:						Time:	90 - 120	minute	S
Cours	ie:	Additive	manufacturi	ng								
Note:	Each	student f	to answer 2-:	3 assigr	nments.	Each ass	ignme	nt carr	ies equal ma	ark.		
SNo	l	USN			Assignr	nent Des	criptio	n		Marks	СО	Level
1			Introduction	to Ad	lditive M	1anufactu	ring: Ir	ntrodu	ction to AM	, 5	CO1	L2
			AM evolutio	n.								
2			Distinction I	oetwee	en AM 8	& CNC m	achini	ng, Ad	vantages o	f 5	CO1	L2
			AM, AM prod	cess ch	nain.							
3			Conceptuali	zation,	CAD, c	onversior	i to ST	L, Tra	nsfer to AM	, 5	CO1	L2
			STL file mar	nipulatio	on.							
4			Machine se	etup, l	build ,	remova	and	clear	n up, post	t 5	CO1	L2
			processing.									
			· · · · · · · · · · · · · · · · · · ·									

STITUTE OF A	SKIT	Teaching Process	Rev No.: 1.0
	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
BANGALORE*	Title:	Course Plan	Page: 12 / 22
Copyright ©2017 cA	AS All rights reserved		

	©2017. CAAS. All rights reserved.			
5	Classification of AM processes: Liquid polymer system,	5	CO1	L2
	Discrete particle system.			
6	Property enhancements using non-thermal and thermal	5	CO1	L2
	techniques.			
7	accuracy improvement, aesthetic improvement, preparation	5	CO1	L2
	for use as a pattern.			
8	Post processing of AM parts: Support material removal,	5	CO1	L2
	surface texture improvement.			
9	Molten material systems and Solid sheet system.	5	CO1	L2
10	Application examples for Aerospace, defence, automobile, Bio-			
	medical and general engineering industries.			
11	What is the difference between hydraulics and pneumatic motors?	5	CO1	L2
12	What are the salient features of AC/DC motors?	5	CO2	L2
13	What do you mean by actuators?List the types of actuators	5	CO2	L2
14	Explain the working of thyristors and triacs ?	5	CO2	L2
15	What are the design parameters while building a hydraulics	5	CO2	L2
16	and pneumatic circuit?		<u> </u>	
	What do you mean by piezoelectric materials actuators?	5	CO2	L2
17	What are the features of shape memory alloy?	5	CO2	L2
18	Give the classification of actuators.	5	CO2	L2
19	With a neat sketch solenoid actuator.	5	CO2	L2
20	With a neat sketch relay and diode actuator.	5	CO2	L2
21	What is the difference between hydraulics and pneumatic motors?	5	CO2	L2

D2. TEACHING PLAN - 2

Module – 3

Title:	Polymers and power metallurgy	Appr Time:	10 Hrs
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Understand the various polymer materials	CO3	L2
2	Micro structure and characterization of polymer materials	CO3	L3
b	Course Schedule		
Class No	Module Content Covered	СО	Level
1	Basic Concepts: Introduction to Polymers used for additive manufacturing.	CO3	L2
2	polyamide,PF resin, polyesters etc.	CO3	L2
3	Classification of polymers, Concept of functionality.	CO3	L2
4	Characterization Techniques:Particle Size & Shape Distribution.	CO3	L2
5	Polydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD].	CO3	L2
6	Powder Production Techniques: Different Mechanical and Chemical methods, Atomization of Powder, other emerging processes.	CO3	L2
7	Electron Microscopy of Powder, InterparticleFriction, Compression ability, Powder Structure, Chemical Characterization.	CO3	L2
8	Microstructure Control in Powder: Importance of Microstructure Study, Microstructures of Powder by Different techniques.	CO3	L2
9	Powder Shaping: Particle Packing Modifications, Lubricants & Binders.	CO3	L2
10	Powder Compaction & Process Variables, Pressure & Density Distribution during Compaction,Isotactic.	CO3	L2

JA INSTITUTE OF THE	SKIT	Teaching Process	Rev No.: 1.0
(IN IN I	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
Sh BANGALORE	Title:	Course Plan	Page: 13 / 22

Copyright ©20	17. cAAS. All rights reserved.		
11	Pressing, Injection Moulding, Powder Extrusion, Slip Casting, Tape Casting.	CO3	L2
12	Application of Powder Metallurgy: Filters, Tungsten Filaments, Self- Lubricating Bearings, Porous Materials, Biomaterials etc.	CO3	L2
С	Application Areas	CO	Level
1	Polymerisation process.	CO3	L2
2	Moulding.	CO3	L3
d	Review Questions	_	_
1	What are the different polymers used in additive manufacturing?	CO3	L2
2	Give the classification polymers	CO3	L2
3	What are the different polymers processing methods?	CO3	L2
4	Explain with a neat wet spinning.	CO3	L2
5	Explain with a neat Dry spinning	CO3	L2
6	What are the compatibility issues with polymers?	CO3	L2
7	What is the future trend of power metallurgy?	CO3	L2
8	What are the different powder production technique?	CO3	L2
9	What do you mean by micro structure control in powder?	CO3	L2
10	Explain with a neat sketch any two sistering process.	CO3	L2
е	Experiences	-	-
1			
2			

Module – 4

Title:	Nano materials and characterization	Appr Time:	10 Hrs
а	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Understand the concept of nano materials.	CO4	L2
2	Analyses and recognize the materials.	CO4	L3
b	Course Schedule		
Class No	Module Content Covered	CO	Level
1	NANO MATERIALS & CHARACTERIZATION TECHNIQUES: Introduction: Importance of Nano-technology, Emergence of Nanotechnology, Bottom-up and Top-down approaches, challenges in NanotechnologyNano-materials	CO4	L2
2	Synthesis and Processing: Methods for creating Nanostructures;Processes for producing ultrafine powders- Mechanical grinding; Wet Chemical	•	L2
3	Synthesis of Nano-materials- sol-gel process; Gas Phase synthesis of Nano-materials-Furnace, Flame assisted ultrasonic spray pyrolysis; Gas Condensation Processing (GPC),Chemical Vapour Condensation(CVC).	CO4	L2
4	Optical Microscopy - principles, Imaging Modes, Applications, Limitations.Scanning Limitations.	CO4	L2
5	Electron Microscopy (SEM) - principles, Imaging Modes, Applications,Limitations.	CO4	L2
6	Transmission Electron Microscopy (TEM) - principles, Imaging Modes.	CO4	L2
7	Limitations.X- Ray Diffraction (XRD) - principles,Imaging	CO4	L2

ASTITUTE OF THE	SKIT	Teaching Process	Rev No.: 1.0
	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
BANGALORE*	Title:	Course Plan	Page: 14 / 22
Convright @2017 cA	AS All rights reserved	1	

Copyright ©20	117. cAAS. All rights reserved. Modes, Applications, Limitations.		
8	Scanning Probe Microscopy (SPM) - principles, ImagingModes,	CO4	L2
0	Applications.	004	
9	Limitations.Electron Probe MicroAnalyzer (EPMA) - Introduction, Sample	CO4	L2
9	preparation, Working procedure, Applications, Limitations.	004	
10	Atomic Force Microscopy (AFM) - basic principles,instrumentation,	CO4	L2
	operational modes, Applications.		
С	Application Areas	СО	Level
1	Material processing	CO4	L2
2	Research domain	CO4	L2
d	Review Questions	-	-
1	What are importance of nano technology,Explain the emergence of nano	CO4	L2
	technology.		
2	What are the different processes involved of nano materials ?	CO4	L2
3	Explain with a neat sketch Gas phased synthesis of nano materials	CO4	L2
4	Explain with a neat sketch flam assisted ultra spray pyrolysis	CO4	L2
5	What do mean by optical microscopy and explain the principles behind it	CO4	L2
6	What do you mean by scanning electron microscope and explain the working principle.	CO4	L2
7	Explain with a neat sketch XRD.		
8	Explain with a neat sketch SPM.	CO4	L2
9	Explain with a neat sketch AFM.	CO4	L2
10	Explain with a neat sketch EPMA.	CO4	L2
е	Experiences	-	-
1			
2			
3			
4			
5			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs C	Code	15ME82	Sem:	VIII	Marks:	15	Time:	75 minute	S	
Cour	ourse: Additive manufacturing									
-	-	Note: Answ	er any 2 qu	lestions, e	ach carry eq	ual marks.		Marks	CO	Level
1	а	What are th	e different	powder pr	oduction tec	hnique?		5	CO3	L2
	b	What do yo	u mean by	micro stru	icture control	in powder?		5	CO3	L2
	С	Explain with	i a neat ske	tch any tw	o sistering p	rocess.		5	CO3	L2
					OR					
2	а	What are th	e compatib	ility issues	s with polyme	ers?		5	CO3	L2
	b	What is the	future tren	d of powe	r metallurgy?			5	CO3	L2
	С	What are th	e different	powder pr	oduction tec	hnique?		5	CO3	L2
3		What are in technology.		of nano te	chnology,Exp	olain the eme	ergence of na	no 5	CO4	L2
	b	What are th	e different	processes	involved of	nano materia	als ?	5	CO4	L2
	С	Explain with	ı a neat ske	tch Gas pl	hased synthe	sis of nano r	naterials	5	CO4	L2
					OR					
4	а	Explain with	ı a neat ske	tch EPMA				5	CO4	L2
	b	What do me	ean by opti	cal micros	copy and exp	lain the prin	ciples behind	it. 5	CO4	L2

JA INST	STITUTE OF A	SKIT	Teaching Process	Rev No.: 1.0			
KRISH		Doc Code:	SKIT.Ph5b1.F02	Date	:03-02-2	2020	
S*BAN	VGALORE *	Title:	Course Plan	Page	: 15 / 22	2	
Copyrig	ht ©2017. (AAS. All rights reserved.					
	c V	Vhat do you r	nean by scanning electron microscope and explain the	5	CO4	L2	
	V	vorking princip	le.				

b. Assignment – 2

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

			ŭ		Mo	del Assignme	nt Questi	ons				
Crs C	ode:	15	ME82	Sem:	VIII	Marks:	05	Time:	75 m	inutes		
Cours				manufactı	<u> </u>							
Note:	Each	sti	udent t	o answer	2-3 assigni	ments. Each as	signmen	t carries equal m	ark.			
SNo	USI	N			As	signment Deso	cription			Mark s	со	Level
1		1	What a	are the diff	erent poly	mers used in a	dditive n	nanufacturing?		5	CO3	L2
2			Give th	e classific	ation poly	mers.				5	CO3	L2
3			What a	are the diff	erent poly	mers processii	ng metho	ods?		5	CO3	L2
4			Explair	n with a ne	eat wet spir	nning.				5	CO3	L2
5			Explair	n with a ne	eat Dry spir	nning.				5	CO3	L2
6			What a	are the co	npatibility	issues with po	lymers?			5	CO3	L2
7			What is	s the futur	re trend of	power metallu	rgy?			5	CO3	L2
8			What a	are the diff	erent pow	der productior	ı techniqı	le?		5	CO3	L2
9		1	What c	do you me	an by mici	o structure co	ntrol in po	owder?		5	CO3	L2
10			Explair	n with a ne	at sketch a	any two sisterir	ng proces	SS.				
11				are impoi echnology		nano technolo	ogy,Expla	in the emergen	ce of	5	CO3	L3
12			What a	are the diff	erent proc	esses involved	d of nanc	materials ?		5	CO4	L2
13			Explair	n with a ne	eat sketch (Gas phased sy	nthesis o	f nano materials.		5	CO4	L2
14			Explair	n with a ne	eat sketch t	lam assisted u	Iltra spray	y pyrolysis.		5	CO4	L2
15		1	What c	do mean b	y optical n	nicroscopy and	l explain	the principles be	hind i	t. 5	CO4	L2
16				do you m g principle		anning electro	n micros	cope and explai	in the	5	CO4	L2
17			Explair	with a ne	eat sketch 2	KRD.				5	CO4	L3
18			Explair	n with a ne	at sketch s	SPM.				5	CO4	L3
19			Explair	n with a ne	at sketch /	AFM.				5	CO4	L2
20			Explair	n with a ne	at sketch l	EPMA				5	CO4	L2
21				are impol echnology		nano technolo	ogy,Expla	in the emergen	ce of	5	CO4	L2

D3. TEACHING PLAN - 3

.		
- 5		
Manufacturing control and automation	Appr	10 Hrs
	Time:	
Course Outcomes	-	Blooms
	-	Level
Students will be able to understand CNC	CO5	L2
Students will be able to apply automation to different process	CO5	L2
Course Schedule		
Module Content Covered	CO	Level
CNC technology - An overview: Introduction to NC/CNC/DNC machine	CO5	L2
tools,Classification of NC /CNC machine tools,		
introduction		
	Course Outcomes Students will be able to understand CNC Students will be able to apply automation to different process Course Schedule Module Content Covered CNC technology - An overview: Introduction to NC/CNC/DNC machine tools, Classification of NC /CNC machine tools,	Manufacturing control and automation Appr Course Outcomes - Students will be able to understand CNC CO5 Students will be able to apply automation to different process CO5 Course Schedule - Module Content Covered CO CNC technology - An overview: Introduction to NC/CNC/DNC machine tools, CO5

MULTINE OF THE STATE	SKIT	Teaching Process	Rev No.: 1.0
(Name	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
BANGALORE*	Title:	Course Plan	Page: 16 / 22
Convright @2017.c/	AS All rights received		

opyright ©20 2	Advantage, disadvantages of NC /CNC machine tools, Application of	CO5	L2
2	NC/CNC Part programming: CNC programming	005	LZ
3	Manual part programming: Basic (Drilling, milling, turning etc.),	CO5	L2
<u> </u>	Programs on drilling, milling and turning	CO5	 L2
 5	Special part programming, Advanced part programming, Computer aided	CO5	 L2
5	part programming(APT)	005	LZ
6	Introduction: Automation in production system principles and strategies of automation, basic Elements of an automated system	CO5	L2
7	Advanced Automation functions.	CO5	L2
8	Levels of Automations, introduction to automation productivity Control Technologies	CO5	L2
9	Automation: Industrial control system. Process industry vs discrete manufacturing industries.	CO5	L2
10	Continuous vs discrete control. Continuous process and its forms. Other control system components.	CO5	L2
C	Application Areas CNC	<u> </u>	
1	Automation	CO5	L2 2
2 d	Review Questions	CO5	L2
1 1	What do you mean by NC, CNC, and DNC.	CO5	L2
2	Give the classification CNC machine tools	CO5 CO5	L2 L2
3	List the advantages and dis-advantages also its applications of CNC	CO5	L2 L2
4	What do you mean by part programming and special part programming?	CO5	L2
5	Explain the computer aided programming?	CO5	 L2
6	What do you mean by automation? List the different types.	CO5	L2
7	What are the strategies of automations	CO5	 L2
8	Explain the different elements of automation .	CO5	 L2
9	Explain the different levels of automation.	CO5	 L2
10	What is the principles of automated systems	CO5	 L2
11	What do you mean by industrial control systems?	CO5	 L2
12	What is the difference between process industries and discrete manufacturing industries?	CO5	L2
13	What are the different continuous process in control technologies	CO5	L2
14	What do you mean by automation productivity.	CO5	L2
е	Experiences	-	-
1			

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs		15ME82	Sem:	VIII	Marks:	15	Time: 7	75 minute	S	
Cod	e:									
Cou	rse:	Additive ma	anufacturing	1						
-	-	Note: Answ	er any 2 qu	estions, eac	h carry equ	al marks.		Marks	СО	Level
1	а	Explain the	computer	aided progr	amming?			7	CO5	L2
	b	What do yo	u mean by	automation?	List the diff	erent types.		8	CO5	L2
					OR					
2	а	What do yo	u mean by	NC, CNC, an	d DNC.			7	CO5	L2
	b	Give the cla	ssification (CNC machin	e tools			8	CO5	L2
3	а	What do yo	u mean by	ndustrial co	ntrol system	IS?		7	CO5	L2
	b	What is t manufactur			en process	industries	and discre	te 8	CO5	L2

WETITUTE OF THE	SKIT	Teaching Process	Rev No.: 1.0
Contraction of the second seco	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
BANGALORE *	Title:	Course Plan	Page: 17 / 22

Copyright @	©2017. cAAS	6. All rights re	eserved.

		OR			
4	а	What is the difference between process industries and discrete	8	CO5	L2
		manufacturing industries?			
	b	What are the different continuous process in control technologies	7	CO5	L2

b. Assignment – 3

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

NOLE.	Ausi		grimerit to be								
				Model	Assignmen	t Quest					
Crs C	ode:	15ME82	Sem:	I	Marks:	5	Т	ime:	90 - 120	minute	S
Cours	se:	Additive	manufacturir	g							
Note:	Each	student	to answer 2-3	assignment	ts. Each ass	ignmer	nt carrie	s equal ma	ark.		
SNo	l	JSN		Assig	nment Des	cription	n	·	Marks	СО	Level
1			What do you	mean by N	C, CNC, and	DNC.			5	CO5	L2
2			Give the class	sification CN	IC machine	tools			5	CO5	L2
3			List the adva of CNC	ntages and	l dis-advan	tages a	also its	applicatior	is 5	CO5	L2
4			What do you programming		part progr	rammin	g and	special pa	rt 5	CO5	L2
5			Explain the c						5	CO5	L2
6			What do you	mean by au	itomation?	List the	differer	nt types.	5	CO5	L2
7			What are the	strategies	of automati	ons			5	CO5	L2
8			Explain the d	fferent elen	nents of aut	tomatic	n.		5	CO5	L2
9			Explain the d	fferent leve	ls of autom	ation.			5	CO5	L2
10			What is the p	rinciples of	automated	system	าร		5	CO5	L2
11			What do you	mean by ind	dustrial cor	itrol sys	stems?		5	CO5	L2
12			What is the discrete man			proce	ess ind	ustries an	d 5	CO5	L2
13			What are t technologies					in contro	ol 5	CO5	L2
14			What do you	mean by au	itomation p	roducti	vity.		5	CO5	L2

F. EXAM PREPARATION

1. University Model Question Paper

Cou	rse:	nth / Year	May .	/2018	
Crs (Code:	15ME82 Sem: VIII Marks: 80 Tim	ie:	180 r	ninutes
-	Note	Answer all FIVE full questions. All questions carry equal marks.	Marks	СО	Level
1	a	Explain Property enhancements using non-thermal and therm	al 7	CO1	L2
		techniques.			
	b	Explain accuracy improvement, aesthetic improvement, preparation f	or 9	CO1	L2
		use as a pattern.			
		OR			
-	a	ExplainPost processing of AM parts, Support material removal, surfac	ce 10	CO1	L2
		texture improvement.			
	b	Write the classification of AM processes, Liquid polymer syster	n, 6	CO1	L2
		Discrete particle system.			
2	a	Explain the working of thyristors and triacs ?	8	CO2	L2
	b	What are the design parameters while building a hydraulics a	and 8	CO2	L2
		pneumatic circuit?			
		OR			
-	a	What are the salient features of AC/DC motors?	8	CO2	L2
	b	What do you mean by actuators?List the types of actuators	8	CO2	L2

ANSTITUTE OF A	SKIT	Teaching Process	Rev No.: 1.0
	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
Stangalone *	Title:	Course Plan	Page: 18 / 22
Copyright ©2017 cA	AS All rights reserved		

Copyrig	ht ©2017.	cAAS. All rights reserved.			
3	а	Explain Electron Microscopy of Powder, Inter particle Friction, Compression ability, Powder Structure, Chemical Characterization.	10	CO3	L2
	b	Write note Microstructure Control in Powder: Importance of Microstructure Study, Microstructures of Powder by Different techniques.	6	CO3	L2
		OR			
-	а	Explain Polydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD].	12	CO3	L2
	b	ExplainPowder Production Techniques, Different Mechanical and Chemical methods, Atomization of Powder, other emerging processes.	4	CO3	L2
4	а	What do you mean by scanning electron microscope and explain the working principle.	8	CO4	L2
	b	Explain with a neat sketch XRD.	8	CO4	L2
		OR			
-	а	Explain with a neat sketch flam assisted ultra spray pyrolysis	6	CO4	L2
	b	What do mean by optical microscopy and explain the principles behind it.	10	CO4	L2
-				00-	
5	a	What is the principles of automated systems	7	CO5	L2
	b	What do you mean by industrial control systems?	9	CO5	L2
		OR			
	а	Explain the different elements of automation .	8	CO5	L2
	b	Explain the different levels of automation.	8	CO5	L2

2. SEE Important Questions

Cour	rse:	Additive ma	anufacturing				Month	/ Year	May /	2018
Crs (Code:	15ME82	Sem:	VIII	Marks:	80	Time:		180 m	inutes
	Note	Answer all F	FIVE full ques	stions. All qu	lestions carry eq	qual marks.		-	-	
Mo dul e	Qno.	Important C	Question					Marks	со	Year
1	1		classificatior rticle system		rocesses: Liqu	id polymer	system,		CO1	
	2	ExplainProp techniques.	-	icements	using non-the	rmal and	thermal		CO1	
	3	Explain acc use as a pat		vement, aes	sthetic improver	ment, prepa	ration for		CO1	
	1	Explain Pos texture imp		of AM parts	s, Support mate	erial remova	l, surface		CO1	
2	1	What are th	e salient feat	ures of AC/	DC motors?				CO2	
	2	What do yo	u mean by a	ctuators?Lis	t the types of ac	ctuators			CO2	
	3	Explain the	working of th	nyristors and	l triacs ?				CO2	
	4	What are pneumatic	0	parameter	s while buildir	ng a hydra	aulics and		CO2	
3	1	Explain Pol Distribution		and Molecu	lar weight [MW	/], Molecula	ar Weight		CO3	
	2	Chemical m	nethods,Atom	nization of P	nniques: Differ owder, other en	nerging proc	cesses.		CO3	
	3	Compressio	on ability, Pov	vder Structu	f Powder, Int Ire, Chemical Ch	naracterizatio	on.		CO3	
	4				owder: Importa Different techni		rostructure	2	CO3	

STITUTE OF THE	SKIT	Teaching Process	Rev No.: 1.0
POTORI	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
BANGALORE*	Title:	Course Plan	Page: 19 / 22

4	1	Explain with a neat sketch flam assisted ultra spray pyrolysis	(204	
	2	What do mean by optical microscopy and explain the principles behind it.	(04	
	3	What do you mean by scanning electron microscope and explain the working principle.	(204	
	4	Explain with a neat sketch XRD.	(204	
5	1	Explain the different elements of automation .	(05	
	2	Explain the different levels of automation.	(205	
	3	What is the principles of automated systems	(205	
	4	What do you mean by industrial control systems?	(05	

G. Content to Course Outcomes

1. TLPA Parameters

Table 1: TLPA – Example Course

Мо	Course Content or Syllabus	Content	Blooms'	Final	Identified	Instructi	Assessment
dul	(Split module content into 2 parts which have		Learning			on	Methods to
e-	similar concepts)	g Hours			Verbs for	Methods	Measure
#				Level	Learning	for	Learning
			Content			Learning	
A	В	С	D	Ε	F	G	Н
	Introduction to Additive Manufacturing:	10	L2	L2	Understa	Chalk	Assignment
	Introduction to AM, AM evolution,Distinction				nd	and	-1
	between AM & CNC machining, Advantages					Board	
	of AM, AM process chain:Conceptualization,						
	CAD, conversion to STL, Transfer to AM, STL						
	file manipulation,						
	Machine setup, build , removal and clean up,						
	post processing.						
	Classification of AM processes: Liquid						
	polymer system,Discrete particle						
	system,Molten material systems and Solid						
	sheet system.Post processing of AM parts:						
	Support mterial removal, surface texture						
	improvement,accuracy improvement,						
	aesthetic improvement, preparation for use						
	as a pattern, property						
	enhancements using non-thermal and						
	thermal techniques.						
	Guidelines for process selection:						
	Introduction, selection methods for a part,						
	challengesof selection						
	AM Applications: Functional models, Pattern						
	for investment and vacuum casting,Medical						
	models, art models, Engineering analysis						
	models, Rapid tooling, new materials						
	development, Bi-metallic parts, Re-						
	manufacturing. Application examples for						
	Aerospace, defence, automobile, Bio-						
	medical and general engineering industries						
	System Drives and devices: Hydraulic and	8	L2	L2	Understa	Chalk	Assignment
	pneumatic motors and their				nd	and	-1

/	HISTITUTE OF	SKIT		Теа	ching Pr	ocess			Rev No	D.: 1.0
A KRISHA			SKIT.Ph5b1.		<u>-</u>					3-02-2020
100	*BANGALORE*	Title:	Course Plar						Page:	20 / 22
Сору		AAS. All rights reserved					1	1]
		s,Electrical mo							Talk	
		SActuators:	Electrical	Actuators;						
		ds, Relays, Di								
	-	licand Pneum		-						
	-	draulic and		c circuits,						
	Piezoele	ectricactuators	s, Shape	memory						
	alloys.									
3	POLYME	ERS & POWDE	ER METALLU	IRGY	12	L2	L2	Understa	Chalk	Assignment
		Concepts: Int						nd	and	-1
	used			anufacturing					Board	
	polyami									
	Classific		olymers, (Concept of						
	function		and Mala							
	Hours I [MW],	Polydispersity Molecular		Distribution						
		Polymer Pro		1ethods of						
		g for additiv								
	spinning			polymers,						
		tibility issues \								
		sting of polym								
		ues General								
		istory of Po								
		andFuture								
		ion Technique								
		hemical me								
	Powder,		emerging	processes.						
		erization Tec Distribution,								
		, Interparticle								
	ability,	Powder	Structure,	Chemical						
		erization Mic								
		: Importance (
		structures of								
		ues Powder S								
	Modifica	ations, Lubrica	ants & Bind	ers, Powder						
		ction & Proce								
		Distribution								
		c Pressing, Inje								
		on, Slip Casting								
		of Sintering,								
		Phase Powde Sintering T								
		nical Propertie								
		y Correlation								
		ues, Defects								
		nentsApplicat		Powder						
	Metallu	rgy: Filters, Tu	ungsten Fila							
	Lubricat	tingBearings,		Materials,						
	Biomate	erials etc.								
4		MATERIALS	& CHARAC	TERIZATION	10	L2	L2	Understa	Chalk	Assignment
	TECHNI	IQUES:						nd	and	-1
	Introduc	ction: Importar	nce of Nano	-technology,					Board	
	Emerge	ence of Nanc	technology,	Bottom-up						
	and To	p-down app	roaches, ch	allenges in						
	Nanoted	chnologyNand	o-materials	Synthesis						
	and I	Processing:	Methods	forcreating						

JANSTITUTE OF THE	SKIT Teaching Process							
	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020					
BANGALORE*	Title:	Course Plan	Page: 21 / 22					
Copyright ©2017. cA	AS. All rights reserved							
Nanostru	Nanostructures; Processes for producing							

	Nanostructures;Processes for producing						
	ultrafine powders- Mechanical grinding; Wet						
	ChemicalSynthesis of Nano-materials- sol-gel						
	process; Gas Phase synthesis of Nano-						
	materials-Furnace, Flame assisted ultrasonic						
	spray pyrolysis; Gas Condensation Processing						
	(GPC),Chemical Vapour						
	Condensation(CVC).Optical Microscopy -						
	principles, Imaging Modes, Applications,						
	Limitations.Scanning Electron Microscopy						
	(SEM) - principles, Imaging Modes,						
	Applications, Limitations. Transmission						
	Electron Microscopy (TEM) - principles,						
	Imaging Modes, Applications, Limitations.X-						
	Ray Diffraction (XRD) - principles, Imaging						
	Modes,Applications, Limitations.Scanning						
	Probe Microscopy (SPM) - principles,						
	ImagingModes, Applications,						
	Limitations.Atomic Force Microscopy (AFM) -						
	basic principles, instrumentation, operational						
	modes, Applications, Limitations. Electron						
	Probe MicroAnalyzer (EPMA) - Introduction,						
	Sample preparation, Working procedure,						
	Applications, Limitations.						
Б	MANUFACTURING CONTROL AND	10	12	12	Understa	Chalk	Assianment
5	MANUFACTURING CONTROL AND	10	L2	L2	Understa nd		Assignment -2
5	AUTOMATION	-	L2	L2	Understa nd	Chalk and Board	Assignment -2
5	AUTOMATION CNC technology - An overview: Introduction	-	L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification	-	L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage,	-	L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC	-	L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part		L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming		L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming:		L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming: Basic (Drilling, milling, turning etc.),		L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming: Basic (Drilling, milling, turning etc.), Specialpart programming, Advanced part		L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming: Basic (Drilling, milling, turning etc.), Specialpart programming, Advanced part programming, Computer aided part	-	L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming: Basic (Drilling, milling, turning etc.), Specialpart programming, Advanced part programming, Computer aided part programming(APT)Introduction: Automation in	-	L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming: Basic (Drilling, milling, turning etc.), Specialpart programming, Advanced part programming, Computer aided part programming(APT)Introduction: Automation in production system principles and strategies	-	L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming: Basic (Drilling, milling, turning etc.), Specialpart programming, Advanced part programming, Computer aided part programming(APT)Introduction: Automation in production system principles and strategies of automation,basic Elements of an		L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming: Basic (Drilling, milling, turning etc.), Specialpart programming, Advanced part programming, Computer aided part programming(APT)Introduction: Automation in production system principles and strategies of automation,basic Elements of an automated system. Advanced Automation	-	L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools, Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming: Basic (Drilling, milling, turning etc.), Specialpart programming, Advanced part programming, Computer aided part programming(APT)Introduction: Automation in production system principles and strategies of automation,basic Elements of an automated system. Advanced Automation functions. Levels ofAutomations, introduction		L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools, Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming: Basic (Drilling, milling, turning etc.), Specialpart programming, Advanced part programming, Computer aided part programming(APT)Introduction: Automation in production system principles and strategies of automation,basic Elements of an automated system. Advanced Automation functions. Levels ofAutomations, introduction to automation productivityControl		L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming: Basic (Drilling, milling, turning etc.), Specialpart programming, Advanced part programming, Computer aided part programming(APT)Introduction: Automation in production system principles and strategies of automation,basic Elements of an automated system. Advanced Automation functions. Levels ofAutomations, introduction to automation productivityControl Technologies in Automation: Industrial control		L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming: Basic (Drilling, milling, turning etc.), Specialpart programming, Advanced part programming, Computer aided part programming(APT)Introduction: Automation in production system principles and strategies of automation,basic Elements of an automated system. Advanced Automation functions. Levels ofAutomations, introduction to automation productivityControl Technologies in Automation: Industrial control system. Process industry vsdiscrete		L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools, Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming: Basic (Drilling, milling, turning etc.), Specialpart programming, Advanced part programming(APT)Introduction: Automation in production system principles and strategies of automation,basic Elements of an automated system. Advanced Automation functions. Levels ofAutomations, introduction to automation productivityControl Technologies in Automation: Industrial control system. Process industry vsdiscrete manufacturing industries. Continuous vs		L2	L2		and	-
5	AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming andintroduction, Manual part programming: Basic (Drilling, milling, turning etc.), Specialpart programming, Advanced part programming, Computer aided part programming(APT)Introduction: Automation in production system principles and strategies of automation,basic Elements of an automated system. Advanced Automation functions. Levels ofAutomations, introduction to automation productivityControl Technologies in Automation: Industrial control system. Process industry vsdiscrete		L2	L2		and	-

2. Concepts and Outcomes:

Table 2: Concept to Outcome – Example Course

Mo Learning or	Identified	Final Concept Concept	CO Components	Course Outcome
dulOutcome	Concepts	Justification	(1.Action Verb,	

AND REAL PROPERTY OF AN	SKIT	Teaching Process	Rev No.: 1.0
	Doc Code:	SKIT.Ph5b1.F02	Date:03-02-2020
##ANGALORE	Title:	Course Plan	Page: 22 / 22

Copy	right ©2017. cAAS. All rig	hts reserved.				
e-	from study of	from			2.Knowledge,	
#		Content		Happened from the		Student Should be
	or Syllabus				Methodology,	able to
				Syllabus. A short	4.Benchmark)	
				word for learning or		
				outcome)		
A	/	J	K	L	M	N
1				Comprehend the	- Understand	Understand the
		additive			method of additive	Process of additive
		manufact		manufacturing	manufacturing	manufacturing
		uring				
	Concept of additive		Process			
	manufacturin					
	g and post					
	processing of					
	AM					
2				Understanding	Understand	Understand concept
		actuators		working principle	actuator working	actuator working.
	to				principle	Ŭ Ŭ
	understand					
	Systems of		working			
	drives,					
	actuators and					
	its types.					
3				Have knowledge of		Understand micro
		power		metallurgy	features of micro	structure of power in
		metallurg			structure	various methods
		У				
	power		micro			
	metallurgy technique		structure			
	and micro		structure			
	structure of					
	power in					
	various					
	methods.					
4				Understand the	Comprehend the	Understand the
.		optical		technology	nano technology	nano technology
		microsco				and optical
		ру.	nano			microscopy
	Concept of		technology			
	nano		le chinology			
	technology					
	and optical					
-	microscopy. Student	automatio		Evolain the working	Indorstand different	Indorctand the
5	student should able				Understand different techniques.	Understand the different automation
	to	11	Control	control techniques		and control
	understand					techniques.
	automation					
	and control					
	techniques.					
L		I	1	1	1	I