GANPAT UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

Programme	Diploma Engineering				Branch	MECHANICAL ENGINEERING		
Semester	VI				Version	1.0.0.0		
Effective from Academic Year		2020-2021			Effective for the batch Admitted in			July 2018
Subject code	1ME2604	Subject Name			Fundamentals of Additive Manufacturing (3D Printing)			
Teaching scheme					Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	1		4	Theory	40	60	100
Hours	3	0	2		5	Practical	30	20	50

Pre-requisites:
Students should be compatible to basics of computer systems operating, basics of engineering drawing and drafting, to perform AutoCAD two dimensional drawings, formal knowledge of limit, fit, tolerances and surface finish symbols.

Course Learning Outcomes:
The course content should be taught and implemented with an aim to develop different skills leading to the achievement of the following competencies and course learning outcomes: CO1. To understand the fundamental and nature of additive manufacturing techniques. CO2. To understand the techniques uses for processing CAD models. CO3. To learn and understand different types of additive manufacturing processes. CO4. To understand various applications and limitations of additive manufacturing processes.

Course Content				
Name of UNIT	**Unit Content**	**Unit Learning Outcomes**	**Marks**	**Hrs**

UNIT – 1 **Introduction**	1.1 General overview about prototyping. 1.2 Traditional manufacturing process Vs. additive manufacturing process for prototyping. 1.3 applications and scope of additive manufacturing processes.	1a. State the need of additive manufacturing along with comparison with traditional manufacturing. 1b. State the applications along with limitation of additive manufacturing.		**5**
UNIT- 2 **Additive Manufacturing Processes**	2.1 Generalized steps in additive manufacturing process 2.2 classification of additive manufacturing process, Principle-process of different AM processes: Photo polymerization based; Extrusion based; Powder bed fusion.	2a. Describe steps in any additive manufacturing process. 2b. Explain different types of additive manufacturing processes.		**20**
UNIT – 3 **Materials in Additive Manufacturing process**	3.1 Different materials uses in AM: Polymer, Ceramic, Metal, Composites etc. 3.2 Use of multifunctional and graded materials.	3a.Explain different types of materials uses in additive manufacturing.		**10**
UNIT – 4 **Data Processing in Additive Manufacturing process**	4.1 Preparation of CAD models, Problems with STL files, STL file manipulation 4.2 RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, and STEP.	4a. explain use of CAD model file formats in additive process.		**5**
UNIT – 5 **Role of Additive Manufacturing in customer market**	5.1 Trends, Business opportunities of different additive manufacturing 5.2 Future applications of additive manufacturing. 5.3 Limitations of additive manufacturing processes 5.4 Scope of research and development in additive	5a. Explain futuristic approach for additive manufacturing in real time.		**5**

	manufacturing			

List of Practical The practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate course learning outcomes.		
No.	**Unit**	**Name of Practical**
1	1	To prepare 3D solid parts using any parametric software
2	3	Print the 3D printed part using any 3D printer.
3	5	Post processing of the 3D printed part using tensile testing.
4	5	Post processing of the 3D printed part using flexure testing.
5	5	Post processing of the 3D printed part using CMM testing.
6	5	Post processing of the 3D printed part using roughness tester.
7	5	Study the dimensional difference between modelled and printed part.

List of Instruments / Equipment / Trainer Board	
1	CAD Workstations.
2	3D printer based on any AM technique
3	Latest educational network version of solid works Creo, Unigraphics, CATIA, Solid Edge, Inventor, software (Any one).

List of Text Books			
No.	**Title of Reference Books**	**Authors**	**Publication**
1	Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing	Gibson, Rosen, Stucker	Springer
2	Rapid Prototyping: Theory and practice	Kamrani A K, Nasr E A	Springer

Link of Learning Web Resource	
1	https://www.youtube.com/watch?v=chVY3dBXBmc
2	https://www.cs.cmu.edu/~scoros/cs15869-s15/lectures/02-3dPrinting.pdf
3	https://www.youtube.com/watch?v=BOIaaXs9JWA

4	http://home.iitk.ac.in/~nsinha/Additive_Manufacturing%20I.pdf
5	https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/112104204/lec47.pdf
6	https://www.youtube.com/watch?v=t8aU5A9XC0E

List of Reference Books

No.	Title of Reference Books	Authors	Publication
1	Rapid Manufacturing: An Industrial Revolution for the Digital Age	Hopkinson, Hague, Dickens	Wiley
2	Advanced Manufacturing Technologies for Medical Applications	Ian Gibson	Willey
3	Rapid Prototyping: Principles and Applications in Manufacturing	Noorani R	John Wiley & Sons
4	Rapid Tooling: Technologies and Industrial Applications	Hilton P, Jacobs P F	CRC Press

CO'S AND PO'S MAPPING

PO'S/CO'S		CO1	CO2	CO3	CO4
PO1	Proficiently applies concepts, theories and techniques of the relevant natural, physical sciences and knowledge in mathematics.	**MED**	**SUB**	**SUB**	**SUB**
PO2	Use basic principles of statics, dynamics, fluid mechanics, and engineering materials, strength of materials engineering standards and manufacturing processes to aid in the design, characterization, and analysis and troubleshooting of mechanical system.	**MED**	**SUB**	**SUB**	**SUB**
PO3	Apply their engineering knowledge, critical thinking and problem solving skills in professional engineering practice or in non-engineering fields, such as law, medicine or business.	**MED**	**SUB**	**SUB**	**SUB**
PO4	Continue their intellectual development, though, for example, graduate education or professional development courses.	**MED**	**MED**	**SUB**	**SUB**
PO5	Use of appropriate computer languages, modern tool and application software that pertain to Mechanical engineering technology systems.	**MED.**	**MED.**	**MED.**	**MED.**
PO6	Ability to identify problems, conducts experiments, gather data, analyse data and produce results.	**SLI.**	**MED.**	**MED.**	**SUB.**
PO7	Retain the intellectual curiosity that motivates lifelong learning and allows for a flexible response to the rapidly evolving challenges of the 21st century	**NONE**	**MED.**	**MED.**	**SUB.**
PO8	Design a system component or process to meet desired need within realistic constraints, such as economic, environmental and social.	**MED.**	**SUB.**	**SUB.**	**SUB.**
PO9	Values the need for, and demonstrates, ethical conduct and professional accountability.	**NONE**	**NONE**	**NONE**	**NONE**

PO10	Demonstrates effective communication to professional and wider audiences.	**SLI**	**SLI**	**SLI**	**SLI**
PO11	Appreciates entrepreneurial approaches to engineering practice.	**MED.**	**MED.**	**MED.**	**SUB.**
PO12	Apply commitment to quality, timeliness, and continuous improvement.	***SLI***	**MED.**	**MED.**	**MED.**