Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech (Full Time) - END SEMESTER EXAMINATIONS, APRIL/MAY 2024

MANUFACTURING ENGINEERING (SEMESTER-VI)

MF5652 - ADDITIVE MANUFACTURING

(Regulation 2019)

Time: 3hrs — Max.Marks: 100

CO 1	To introduce the development of Additive Manufacturing (AM), various business opportunities and applications
CO 2	To familiarize various software tools, processes and techniques to create physical objects that satisfy product development / prototyping requirements, using AM
CO 3	To be acquainted with vat polymerization and material extrusion processes.
CO 4	To be familiar with powder bed fusion and direct energy deposition.
CO 5	To gain knowledge on applications of binder jetting, material jetting and laminated object manufacturing processes

BL – Bloom's Taxonomy Levels
(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

PART – A (10 x 2 = 20 Marks)

(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1	Why is AM necessary in the current scenario?	2	CO 1	L2
2	Differentiate between hard tooling and soft tooling.	2	CO 1	L1
3	What is the difference between Topology and Geometry?	2	CO 2	L2
4	How do slicing techniques affect the fabrication process?	2	CO 2	L2
5	List the limitations of the SLA process.	2	CO 3	L1
6	Draw the schematic diagram of FDM process.	2	CO 3	L1
7	Why are EBM parts built in a vacuum?	2	CO 4	L2
8	How does the laser selectively fuse the powder particles to create a solid part?	2	CO 4	L2
9	How does the Multi-Jet modelling process work?	2	CO 5	L2
10	What is decubing? Why is it needed?	2	CO 5	L2

PART- B (5 x 13 = 65 Marks)

Q. No	Questions	Marks	CO	BL
11 (a) (i)	Define and classify AM as per ASTM standards.	4	CO 1	L1
(ii)	Describe the need and development of the AM process.	9	CO 1	L3
	OR			
11 (b)(i)	Write a short note on the business opportunity and intellectual property of AM.	4	CO 1	L1
(ii)	With a case study/application, explain in detail the impact of AM in the healthcare sector.	9	CO 1	L3
12 (a)	Describe, how the unique capabilities of AM adopt part consolidation, topology optimization, and lightweight structures in new product development.	13	CO 2	L3
	OR			

12 (b) (i)	With a neat sketch, explain the staircase effect and STL file errors during CAD to STL file conversion.	4	CO 2	L3
(ii)	How do support structures and part orientation affect the part quality? With a neat diagram, explain different types of tool path generation in the AM process.	9	CO 2	L3
13 (a)	How is DLP faster than SLA? Explain the working principle of DLP with a neat sketch and list its capabilities, applications, and limitations.	13	CO 3	L4
	OR			
13 (b)	What are the process variables in FDM and how it affects the product quality? Discuss its materials, applications and limitations.	13	CO 3	L4
14 (a)(i)	Explain the basic process of Selective Laser Melting (SLM) with a neat diagram. How does it differ from SLS? Write short notes on the materials used.	9	CO 4	L4
(ii)	Differentiate between SLM and EBM processes.	4	CO 4	L4
	OR			
14 (b)	With the neat diagram explain the AM process used for repair and servicing work of large metal components. Mention the materials, capabilities and limitations of this process.	13	CO 4	L4
15 (a)	Which AM process uses sheets of material to produce parts? Describe its working principle and its bonding mechanism in detail with a neat sketch. List its materials, applications and limitations.	13	CO 5	L4
	OR			
15 (b)	Describe the process of Binder Jetting in Three Dimensional Printing (3DP) with a neat sketch and explain the role of post-processing techniques in enhancing its properties. List its industrial applications.	13	CO 5	L4

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q. No	Questions	Marks	CO	BL
16.	Which is the suitable AM process used for fabricating components having multiple colours, multi-material and superior mechanical properties with varying degrees of flexibility? With a case study/application, describe the procedural steps involved.	15	CO 5	L6