Reg. No. : | | | | | | | | | | | | |

Question Paper Code:U7202

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

Professional Elective

Mechanical Engineering

21MEV202 ADDITIVE MANUFACTURING

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Which of the following is NOT a key phase in the development of Additive Manufacturing (AM) technology? CO1-U

   (a) Rapid Prototyping (b)Rapid Tooling

   (c)Rapid Manufacturing (d)Rapid Cooling

2. Which of the following applications utilizes Additive Manufacturing for creating functional organs and tissues? CO1- U

   (a) Building Printing (b) Food Printing

   (c) Bio Printing (d) Electronics Printing

3. Generative design in AM refers to CO1- U

   (a) A traditional design method

   (b) A design approach that uses algorithms and AI to create optimized structures

   (c) A manual process for producing designs

   (d) A process for adding color to printed parts

4. What is the role of support structures in Additive Manufacturing? CO1- U

   (a) To add material to parts that do not require it

   (b) To stabilize overhanging features during the build process

   (c) To increase the cost of the print

   (d) To reduce the strength of the part

5. Which material is commonly used in Stereolithography (SLA) printing? CO1- U

(a)Metal powder (b)Photopolymer resin

(c)Plastic filament (d) Ceramics

6. Which materials can be used in Laser Engineered Net Shaping (LENS)? CO1- U

(a)High resolution (b) Ability to repair and remanufacture parts

(c)Large-scale production (d) Suitable only for plastic parts

7. Which of the following materials is commonly used in SLM? CO1- U

(a)Plastics (b) Titanium alloys (c) Photopolymer resins (d) Concrete

8. What material is typically used in Fused Deposition Modeling (FDM)? CO1- U

(a) EBM uses an electron beam instead of a laser

(b) EBM can only work with plastic materials

(c) EBM sinters powder instead of melting it

(d) EBM uses light projection for curing

9. What material is commonly used in the Binder Jetting process? CO1- U

(a) Thermoplastic filament (b) Photopolymer resin

(c) Metal, sand, or ceramic powders (d) Liquid ink

10. What is the basic principle behind Laminated Object Manufacturing (LOM)? CO1- U

(a) Fusing powder layers with a laser

(b) Extruding melted material layer by layer

(c) Bonding layers of material sheets through adhesive or heat

(d) Using UV light to cure liquid resin

PART – B (5 x 2= 10 Marks)

11. What is bio printing in AM? CO1 -U

12. Why are lattice structures commonly used in AM? CO1 -U

13. What materials can be used in LENS? CO1 -U

14. How does Electron Beam Melting (EBM) differ from SLM in terms of the energy source? CO4-AP

15. What materials are typically used in Material Jetting (MJM)? CO1 -U

PART – C (5 x 16= 80 Marks)

16.	(a)	Identify the need for Additive Manufacturing (AM) technology and discuss its development from Rapid Prototyping, Rapid Tooling, Rapid Manufacturing to modern AM.	CO2 - App	(16)
		Or		
	(b)	Identify the application of Additive Manufacturing in the construction industry, specifically focusing on Building Printing. Discuss its potential advantages, challenges, and the impact on the future of construction.	CO2 - App	(16)
17.	(a)	Identify the unique capabilities of Additive Manufacturing that make it suitable for advanced manufacturing applications. Discuss how these capabilities lead to innovations in product design and manufacturing efficiency	CO2 - App	(16)
		Or		
	(b)	Develop the concept of multi-material parts and graded materials in Additive Manufacturing. Discuss the potential advantages and challenges in the fabrication of such parts, including material compatibility, structural integrity, and performance enhancement	CO2 - App	(16)
18.	(a)	Construct the top-down and bottom-up approaches in Stereolithography Apparatus (SLA) technology. How do these approaches affect build speed, part quality, and limitations? Provide relevant industrial examples for each approach.	CO3 - App	(16)
		Or		
	(b)	Identifythe advantages of Continuous Liquid Interface Production (CLIP) technology. Provide examples of industries where CLIP is being applied, and explain why CLIP is beneficial in these contexts	CO3 - App	(16)
19.	(a)	Identify the range of materials used in Selective Laser Sintering (SLS) and their characteristics. Explain the suitability of these materials for various industrial applications, focusing on polymers, metals, and composites.	CO4 - App	(16)
		Or		
	(b)	Identiy the advantages of Selective Laser Melting (SLM) over other Additive Manufacturing methods. Discuss its applications in industries requiring high-precision, high-strength metal components, such as aerospace, defense, and medical devices	CO4 - App	(16)

20. (a) Identify the types of materials used in Binder Jetting (3DP), including metals, ceramics, and polymers. Explain the characteristics and suitability of these materials for different applications in industries like automotive, aerospace, and healthcare — CO5 - App — (16)

Or

(b) Choose the mechanisms of gluing or adhesive bonding and thermal bonding in Laminated Object Manufacturing (LOM). How do these mechanisms influence the strength, precision, and durability of the final part? Provide examples where each bonding mechanism is preferred — CO5 - App — (16)