Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem Examination Dec-2023

ME3EL25 Additive Manufacturing

Programme: B.Tech. Branch/Specialisation: ME

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. What is the fundamental difference between subtractive and additive manufacturing? **1**

(a) Subtractive uses material removal; additive builds layer by layer
(b) Subtractive builds layer by layer; additive uses material removal
(c) Both use the same process
(d) Neither uses material removal

ii. In terms of sustainability, which manufacturing method is often considered more environmentally friendly? **1**

(a) Subtractive manufacturing
(b) Additive manufacturing
(c) Both have similar environmental impacts
(d) Neither has significant environmental impacts

iii. Which of the following is a liquid-based additive manufacturing process? **1**

(a) Fused Deposition Modeling (FDM)
(b) Stereolithography (SLA)
(c) Selective Laser Sintering (SLS)
(d) CNC Machining

iv. In solid-based additive manufacturing, what happens to the material after each layer is deposited or melted? **1**

(a) It solidifies through cooling or bonding
(b) It remains in the same state
(c) It is ejected as waste
(d) It undergoes a chemical reaction

v. What is the primary state of material in powder-based additive manufacturing during the printing process? **1**
(a) Liquid (b) Solid
(c) Gas (d) Powder

vi. What is a key advantage of powder-based additive manufacturing in terms of design flexibility? **1**
(a) Limited design options
(b) High tooling constraints
(c) Complex geometries without support structures
(d) Inability to create intricate structures

vii. What is a key application of direct energy deposition in manufacturing? **1**
(a) Low-resolution prototyping
(b) High-speed machining
(c) Repair and refurbishment of parts
(d) Mass production of small components

viii. In direct energy deposition, how is material deposited onto the substrate or previous layers? **1**
(a) By injection molding
(b) By extruding a continuous filament
(c) By using a laser to melt and fuse powdered material
(d) By using a directed energy source to melt and deposit material

ix. What is the primary function of the friction stir welding tool in FSAM? **1**
(a) Material removal (b) Layer-by-layer deposition
(c) Joining and bonding materials (d) Laser cutting

x. In hybrid additive-subtractive manufacturing, how is material added and removed in the same process? **1**
(a) Sequentially, with separate machines
(b) Simultaneously, using a combination of tools
(c) Material is only added, not removed
(d) Material is only removed, not added

Q.2 i. Compare and contrast Additive Manufacturing (AM) with reverse engineering **3**

ii. Discuss the role and impact of Additive Manufacturing (AM) technology in product development. **7**

OR iii. Discuss the challenges and advancements associated with selecting and optimizing materials for different AM processes. **7**

Q.3 i. Explain the classification of liquid-based additive manufacturing systems. **3**

ii. Elaborate the principles & processes Fused Deposition Modelling (FDM). **7**

OR iii. Elaborate on the advantages, and applications of solid-based additive manufacturing systems. **7**

Q.4 i. Write any three limitations of selective laser sintering. **3**

ii. Explain the principle of DMLS process. Also write the advantages and limitations, **7**

OR iii. Explain the principle, advantages, and limitations of 3D printing. **7**

Q.5 i. Write any three advantages of electron beam freedom fabrication principles. **3**

ii. Explain the principle of wire-laser AM. Also write the advantages and limitations. **7**

OR iii. Explain the principle of Wire Arc Additive Manufacturing (WAAM). Also write the advantages and limitations. **7**

Q.6 i. What are the various types of post-machining operations with respect to heat treatment? **3**

ii. Explain Friction Stir Additive Manufacturing (FSAM) with the help of neat sketch. **7**

OR iii. Explain hybrid additive- subtractive manufacturing in detail. **7**

******

Marking Scheme

ME3EL25 (T)-Additive Manufacturing (T)

Q.1	i)	a. Subtractive uses material removal; Additive builds layer by layer	**1**
	ii)	b. Additive Manufacturing	**1**
	iii)	b. Stereolithography (SLA)	**1**
	iv)	a. It solidifies through cooling or bonding	**1**
	v)	d. Powder	**1**
	vi)	c. Complex geometries without support structures	**1**
	vii)	c. Repair and refurbishment of parts	**1**
	viii)	d. By using a directed energy source to melt and deposit material	**1**
	ix)	c. Joining and bonding materials	**1**
	x)	b. Simultaneously, using a combination of tools	**1**

Q.2	i.	Compare…… 1.5 marks and contrast Additive Manufacturing (AM) with Reverse Engineering…… 1.5 marks	
	ii.	Discuss the role…… 3 marks and impact of Additive Manufacturing (AM) technology in product development. …… 4 marks	
OR	iii.	Discuss the challenges…….…… 3 marks and advancements associated with selecting and optimizing materials for different AM processes. ……4 marks	

Q.3	i.	Explain the classification of Liquid-Based Additive Manufacturing systems…… 3 marks	
	ii.	Elaborate the principles…… 4 marks & processes Fused Deposition Modelling (FDM) ……3 marks	
OR	iii.	Elaborate on the advantages, and applications of Solid-Based Additive Manufacturing systems. …… 3 marks	

Q.4	i.	Write any three limitations of Selective Laser Sintering. ……3 marks	
	ii.	Explain the Principle of DMLS process…… 3 marks write the advantages…… 2 marks	
		and limitations…… 2 marks	
OR	iii.	Explain the Principle…… 3 marks advantages…… 2 marks limitations of 3D printing. …… 2 marks	

Q.5	i.	Write any three advantages of Electron Beam Freedom Fabrication Principles. …… 3 marks	
	ii.	Explain the principle of Wire-Laser AM. …… 3 marks Also write the advantages …… 2 marks and limitations. …… 2 marks	
OR	iii.	Explain the principle of Wire Arc Additive Manufacturing (WAAM). …… 3 marks Also write the advantages …… 2 marks and limitations. …… 2 marks	

Q.6	i.	What are the various types of post-machining operations with respect to heat treatment. …… 3 marks	
	ii.	Explain Friction Stir Additive Manufacturing (FSAM) with the help of neat sketch. …… 3 marks	
OR	iii.	Explain Hybrid Additive- Subtractive Manufacturing in detail. …… 3 marks	

******