Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES

End Semester Examination, May 2024

Course: **Rapid Prototyping and Tooling** **Semester:** **VI**
Program: **B Tech Mechanical Engineering** **Time:** **03 hrs.**
Course Code: **MECH3049** **Max. Marks:** **100**

Instructions:
Answer all questions.
Read each question carefully before answering.
Provide clear explanations where necessary.
Use diagrams or sketches to support your answers when appropriate.

SECTION A
(5Qx4M=20Marks)

S. No.		**Marks**	**CO**
Q 1	Enumerate four key attributes of a well-designed product.	**4**	**CO1**
Q 2	i. Identify the primary purpose of rapid prototyping in product development from the following options? a) Mass production of final products b) Testing and validating design concepts c) Recycling of waste materials d) Marketing and advertising campaigns ii. Identify the additive manufacturing process that employs a focused laser beam to selectively melt metal powder, layer by layer: a) Electron Beam Melting (EBM) b) Selective Laser Sintering (SLS) c) Direct Metal Laser Sintering (DMLS) d) Stereolithography (SLA) iii. Rapid prototyping is often used in which phase of product development? a) Final production b) Testing and validation c) Marketing and sales d) Distribution and logistics	**1x4**	**CO1**

	iv. Which additive manufacturing method is commonly used for producing ceramic components with high precision and intricate geometries? a) Electron Beam Melting (EBM) b) Digital Light Processing (DLP) c) Selective Laser Melting (SLM) d) Powder Bed Fusion (PBF)		
Q 3	Explain the similarities and differences between rapid tooling and rapid prototyping	**4**	**CO1**
Q 4	Enumerate the materials appropriate for the FDM process.	**4**	**CO2**
Q 5	Discuss four important process parameters of Directed Energy Deposition (DED).	**4**	**CO1**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	Discuss how a poorly defined design problem can hinder the design process and lead to suboptimal outcomes. Provide examples to support your analysis.	**10**	**CO4**
Q 7	Explain the working principle fused deposition modelling and explain briefly the important process parameters.	**10**	**CO3**
Q 8	Discuss in detail the various post processing techniques and characterization techniques used in additive manufacturing.	**10**	**CO3**
Q 9	Discuss the drawbacks and practical applications of the Solid Ground Curing (SGC) system in additive manufacturing.	**10**	**CO2**
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	Discuss the significance of process parameters in ultrasonic consolidation (UC) and propose an optimized set of parameters for bonding dissimilar metal foils. Consider factors such as ultrasonic frequency, vibration amplitude, welding pressure, and dwell time. Justify your parameter selection based on their impact on bond strength, microstructure, and potential challenges associated with bonding dissimilar metals. Additionally, propose strategies for mitigating any potential defects or inconsistencies in the bonding process.	**20**	**CO4**
Q 11	How would you design a custom implant for a patient using Ballistic Particle Manufacturing (BPM), considering factors such as material selection, design optimization for biocompatibility and mechanical strength, and post-processing requirements? Justify your design choices	**20**	**CO4**

	based on the capabilities and limitations of BPM and propose a plan for validating the implant's performance in vivo. Or Design a comprehensive workflow for utilizing LENS in the production of a complex aerospace component, such as a turbine blade. Consider factors such as material selection, build orientation optimization, post-curing techniques, and quality control measures. Justify each step of your workflow based on the advantages and limitations of LENS and propose strategies for ensuring the final component meets industry standards for strength, durability, and dimensional accuracy.		