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Question Paper Code: U9773

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2025

Open elective

21UME973 – INTRODUCTION TO ADDITIVE MANUFACTURING

(Common to All Engineering branches)

(Regulations 2021)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. What is the main advantage of Rapid Prototyping in Additive Manufacturing?   CO1-U

   (a) Low cost of mass production

   (b) Shorter lead times for creating prototypes

   (c) High production speed for large-scale manufacturing

   (d) Uniform cooling of the material

2. What is the primary focus of Rapid Tooling in the AM process chain?   CO1-U

   (a) Creating large batches of products   (b) Producing functional prototypes

   (c) Fabricating molds or dies quickly   (d) Developing design concepts

3. Topology optimization in Additive Manufacturing primarily aims to   CO1-U

   (a) Minimize material usage while maintaining strength

   (b) Simplify the manufacturing process

   (c) Maximize the weight of the component

   (d) Increase the number of support structures needed

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 of the following is a limitation of SLA?　　　　　　　　　CO1-U

(a) Low accuracy　　　　　　　　　　　(b) Limited material choices

(c) Slow printing speed　　　　　　　　(d) Poor surface finish

6. Which application is common for SLA technology?　　　　　　　CO1-U

(a) Printing flexible electronics　　　(b) Creating dental models and jewelry molds

(c) Metal part manufacturing　　　　　(d) Large-scale construction

7. Which of the following is a common application of SLS?　　　　CO1-U

(a) Printing large-scale construction parts

(b) Creating medical implants

(c) Prototyping and low-volume production of complex geometries

(d) Printing food products

8. What is a limitation of FDM compared to other AM technologies?　　CO1-U

(a) Limited build size　　　　　　　　(b) Lower resolution and surface finish

(c) High production costs　　　　　　　(d) Limited material selection

9. What is the role of the binder in Binder Jetting?　　　　　　　CO1-U

(a) To melt the material　　　　　　(b) To bond powder particles together

(c) To extrude material through a nozzle　(d) To remove excess material

10. What is a limitation of the Laminated Object Manufacturing (LOM) process?　　CO1-U

(a) Limited ability to print complex geometries　(b) High cost of material

(c) High energy consumption　　　　　　(d) Limited surface finish quality

PART – B (5 x 2= 10 Marks)

11. What is rapid manufacturing in AM?　　　　　　　　　　　CO1-U

12. What is generative design, and how is it applied in AM?　　　　　CO1-U

13. What materials are used in Stereo lithography Apparatus (SLA)?　　CO1-U

14. What is the key difference between SLM and SLS in terms of material　CO1-U processing?

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

PART – C (5 x 16= 80 Marks)

16. (a) Construct the Additive Manufacturing (AM) process chain in　CO2-App　(16) detail, starting from CAD model preparation to post-processing.

Or

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(b) Develop the business opportunities presented by Additive Manufacturing across various industries. Discuss future directions, including emerging trends, advancements in materials, and the potential for mass customization.   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.   CO3-App   (16)

Or

(b) Plan the process of CAD model preparation for Additive Manufacturing. Discuss the critical steps involved, including design considerations, model validation, and optimization for the AM process. How does CAD model preparation affect the overall quality of the final product?   CO3-App   (16)

18. (a) Construct the top-down and bottom-up approaches in Stereo lithography Apparatus (SLA) technology. How do these approaches affect build speed, part quality, and limitations? Provide relevant industrial examples for each approach.   CO4 - App   (16)

Or

(b) Identify the applications of Digital Light Processing (DLP) in industries such as dentistry, jewelry, and consumer products. How does DLP's precision and speed make it suitable for these industries? Provide examples to illustrate its application.   CO4 - App   (16)

19. (a) Develop the powder fusion mechanism in Selective Laser Sintering (SLS). How does the powder material fuse to form a solid part, and what factors influence the fusion quality? Discuss considerations such as temperature, powder size, and laser power.   CO5 - App   (16)

Or

(b) Construct the working of Electron Beam Melting (EBM). How does the process differ from Selective Laser Melting (SLM), particularly in terms of energy source, powder fusion, and material properties?   CO5 - App   (16)

20. (a) Construct the process of Binder Jetting in Three-Dimensional Printing (3DP). Describe the steps involved, from powder deposition to binder application, and discuss how parts are formed and post-processed in this technique.   CO6 -App   (16)

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(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. CO6- App (16)