REF.NO. EX/PROD/PC/H/T/422/2024

B.E. PRODUCTION ENGINEERING FOURTH YEAR SECOND SEMESTER EXAMINATION, 2024

ADDITIVE MANUFACTURING (HONS.)

Time: Three Hours Full Marks:100

Answer any FIVE questions

1. a) What are the needs of Additive Manufacturing? Classify Additive Manufacturing techniques based on the phase of input build materials.
   b) Discuss about the various steps of Additive Manufacturing process?
   c) What are the advantages and limitation of Additive Manufacturing?

(8+6+6)

2. Match the followings (10x 2)

1. FDM	A. Metallic Wire
2. SLS	B. Liquid resin
3. SLM	C. AM with High Energy Beam
4. SGC	D. Rapid Steel 1.0
5. EBM	E. Metal Implant by Laser
6. LOM	F. ABS Filament
7. LENS	G. Multiple part fabrication
8. WAAM	H. Ink jet printing
9. SLA	I. Repair metal parts
10. 3DP	J. Sheet Lamination

3. Describe the working principle of the following AM process with sketch highlighting the merits and demerits of it.
   a) Solid Ground Curing (SGC)
   b) 3 D Printing based on Ink jet Printing Technology

(10+10)

4. a) What is Reverse Engineering? Explain the processes of Reverse Engineering.
   b) What is Rapid Tooling? Distinguish between Direct Rapid Tooling and Indirect Rapid Tooling? What are the applications of Rapid Tooling in Investment Casting?

(8+12)

5. Describe the working principle of the following AM process with sketch highlighting the strength and weakness of it.

   a) Selective Laser Melting (SLM)
   b) Wire Arc Additive Manufacturing (WAAM)

   10+10)

6. Describe the working principle of the following AM process with sketch highlighting the advantages and drawbacks of it.
   a) Electron Beam Melting (EBM)
   b) Laminated Object Manufacturing (LOM)

   (10+10)

7. a) Describe the working principle of the Fused Deposition Modeling (FDM) process with sketch highlighting the strength and weakness of it.

   b) The extruder head in a fused deposition modeling setup has a diameter of 1.20 mm and produces layers that are 0.20 mm thick. The extruder head and polymer extrudate velocities are both 40 mm/s. There is a delay of 10 seconds between layers as the extruder head is moved over a wire brush for cleaning. Calculate the production time for the generation of a solid cube of dimension of 50mm.

   (10+10)

8. a) Describe the working principle of the Stereo Lithography Apparatus (SLA) process with sketch highlighting the merits and demerits of it.

   b) A hollow cylindrical object of inner diameter 40 mm, wall thickness 5mm and height 70 mm is to be made by SLA process. The process uses laser beam which moves across the surface of liquid resin at a velocity of 400 mm/s. Thickness of each layer formed by the process is 0.25 mm. The time required to build the part is 1 hour 30 minutes. Assume 10 seconds are lost after each layer to lower the platform. Determine the required spot size of the laser beam.

   (10+10)