Reg. No.																

Question Paper Code	14350

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

Seventh Semester

Mechanical Engineering

20MEPW701 - 3D PRINTING AND SUSTAINABLE DESIGN WITH LABORATORY

Regulations - 2020

Duration: 3 Hours Max. Marks: 100

PART – A (i) (MCQ)
(16 × 1 = 16 Marks)
Answer ALL Questions

		Marks	*K – Level*	*CO*
1.	Which file format is most commonly used in 3D printing for transferring CAD models? a) DOC b) STL c) XLS d) PPT	*1*	*K1*	*CO1*
2.	Additive Manufacturing processes are primarily classified based on. a) Product color b) Layer creation method c) Company size d) Packaging method	*1*	*K1*	*CO1*
3.	How does 3D printing improve product development? a) By increasing material waste b) By reducing prototype development time c) By eliminating CAD software d) By increasing assembly complexity	*1*	*K2*	*CO1*
4.	_____ geometric modeling technique represents an object using only edges and vertices. a) Surface modeling b) Parametric modeling c) Wireframe modeling d) Solid modeling	*1*	*K1*	*CO2*
5.	Tool path generation in additive manufacturing determines: a) Material color b) Printer movement path c) Product packaging d) Machine cost	*1*	*K1*	*CO2*
6.	The data processing in rapid prototyping, _____. a) It converts CAD models into printable data b) It increases product weight c) It avoids model slicing d) It removes all support structures	*1*	*K2*	*CO2*
7.	Laminated Object Manufacturing (LOM) produces parts by: a) Extruding molten plastic b) Joining powder particles with laser c) Laminating sheets layer by layer d) Melting metal wire using arc welding	*1*	*K1*	*CO3*
8.	Electron Beam Melting (EBM) uses: a) UV light b) Water jet c) Plasma spray d) Electron beam	*1*	*K1*	*CO3*
9.	Infer Hybrid Additive Manufacturing techniques preferred in advanced manufacturing. a) They eliminate machining operations completely b)They combine additive and conventional manufacturing advantages c) They avoid digital design methods d)They reduce material strength intentionally	*1*	*K2*	*CO3*
10.	Sustainable development mainly aims to balance a) Cost and advertising b) Environment, economy, and society c) Production and taxation d) Marketing and sales	*1*	*K1*	*CO4*
11.	Product Life Cycle Assessment (LCA) evaluates: a) Employee performance b) Product transportation cost only c) Environmental impact throughout product life d) Machine maintenance schedule	*1*	*K1*	*CO4*

12.	Diverse approaches to Design for Sustainability mainly focus on_____. a) Increasing energy consumption b) Reducing environmental impact during product design c) Replacing CAD software d) Eliminating recycling methods	*1*	*K2*	*CO4*
13.	A Sustainable Product-Service System (PSS) combines: a) Products and environmental laws only b)Products and services together c)Marketing and packaging d)Machines and labor unions	*1*	*K1*	*CO5*
14.	Sustainable manufacturing primarily aims to_____. a) Increase pollution b) Minimize environmental impact c) Reduce automation d) Maximize material waste	*1*	*K1*	*CO5*
15.	The Sufficiency Economy Philosophy in Sustainable PSS Thinking emphasizes: a) Excessive production b) Balanced and moderate resource utilization c) Maximum resource extraction d) Continuous material disposal	*1*	*K2*	*CO5*
16.	Global Value Creation Modeling in sustainable manufacturing helps industries to: a) Increase waste generation b) Improve value across the production network c) Eliminate automation d) Reduce communication systems	*1*	*K2*	*CO5*

PART – A (ii) (Short Answer Questions)
(8 × 3 = 24 Marks)
Answer ALL Questions

17.	List the advantages of using 3D printing technology during disaster relief operations.	*3*	*K2*	*CO1*
18.	Explain the concept of Virtual Prototyping and mention any two advantages of using it in product development.	*3*	*K2*	*CO1*
19.	Explain soft tooling in additive manufacturing? List any three characteristics of soft tooling.	*3*	*K2*	*CO2*
20.	Discuss model reconstruction in digitization techniques? Briefly explain its purpose in additive manufacturing.	*3*	*K3*	*CO2*
21.	Identify the advantages and one limitations of Digital Light Processing (DLP) in 3D printing.	*3*	*K3*	*CO3*
22.	Define productivity and sustainability. State how sustainability can improve productivity in manufacturing industries.	*3*	*K2*	*CO4*
23.	List any three important process variables involved in DLP-based 3D printing.	*3*	*K2*	*CO4*
24.	Mention any three challenges faced in implementing Sustainable Product-Service Systems.	*3*	*K3*	*CO5*

PART - B (Descriptive Answer Questions)
(5 × 12 = 60 Marks)
Answer ALL Questions

25.	a)	Explain the evolution of 3D Printing technology and discuss the complete Additive Manufacturing (AM) process chain with neat illustrations.	*12*	*K3*	*CO1*
		OR			
	b)	Discuss the role of 3D Printing in Product Development and explain its applications in Industry 4.0 with suitable examples.	*12*	*K3*	*CO1*
26.	a)	Infer the digitization techniques used in Additive Manufacturing. Discuss wireframe, surface, and solid modeling methods in detail.	*12*	*K3*	*CO2*
		OR			
	b)	Describe the importance of part orientation in Additive Manufacturing and explain support structure design, model slicing, and tool path generation processes.	*12*	*K3*	*CO2*

27.	a)	Explain the working principle of Fused Deposition Modeling (FDM). Discuss its process parameters, materials used, advantages, limitations, and applications.	*12*	*K3*	*CO3*
		OR			
	b)	Compare SLS, SLM, and EBM processes based on working principle, materials, advantages, limitations, and industrial applications.	*12*	*K3*	*CO3*
28.	a)	Explain the concepts of Sustainability and Sustainable Development. Discuss the systems approach to sustainable design with suitable examples.	*12*	*K3*	*CO4*
		OR			
	b)	Describe Product Life Cycle Design and explain various Life Cycle Assessment (LCA) techniques used in sustainable product development.	*12*	*K3*	*CO4*
29.	a)	Explain Sustainable Product-Service System (PSS) design. Discuss its challenges, methods, and tools used for sustainable development.	*12*	*K3*	*CO5*
		OR			
	b)	Discuss the concepts of Cleaner Production, Remanufacturing, and opportunities of Sustainable Manufacturing in Industry 4.0.	*12*	*K3*	*CO5*