Reg. No.															

Question Paper Code	13429

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Seventh Semester

Mechanical Engineering

20MEPW701 - 3D PRINTING AND SUSTAINABLE DESIGN WITH LABORATORY

Regulations - 2020

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	*K – Level*	*CO*
1.	Which of the following is NOT a typical material used in 3D printing? (a) Plastic (b) Metal (c) Paper (d) Wood	*1*	*K2*	*CO1*
2.	In the AM process chain, which operation is performed during post-processing? (a) Creating the 3D model (b) Printing the part layer by layer (c) Cleaning, curing, and finishing the printed part (d) Selecting the material	*1*	*K1*	*CO1*
3.	In rapid prototyping, which data processing technique converts a 3D model into a series of thin slices? (a) Part orientation (b) Model slicing (c) Data interfacing (d) Mesh refinement	*1*	*K1*	*CO2*
4.	In rapid tooling, what is the advantage of using bridge tooling? (a) It offers a temporary solution for low-volume production (b) It reduces the material cost for high-volume production (c) It can be used to make high-precision parts (d) It provides fast delivery for mass-market goods	*1*	*K1*	*CO2*
5.	Which of the following 3D printing technologies is most commonly used in Industry 4.0? (a) Fused Deposition Modeling (FDM) (b) Selective Laser Sintering (SLS) (c) Binder Jetting (d) All of the above	*1*	*K1*	*CO3*
6.	In what industry is Hybrid Additive Manufacturing particularly beneficial? (a) Electronics (b) Aerospace (c) Food manufacturing (d) Textile	*1*	*K1*	*CO3*
7.	In the early stages of sustainable design, which of the following was most commonly prioritized? (a) Aesthetics and visual appeal (b) Minimizing environmental impacts, especially waste and pollution (c) Enhancing product functionality without regard to environmental effects (d) Speeding up the production process without considering product longevity	*1*	*K1*	*CO4*
8.	Sustainable design practices focus on improving the life cycle impacts of products, considering_____ (a) Only the production phase (b) The entire life cycle, from raw material extraction to end-of-life disposal (c) The sales and marketing phases only (d) Short-term profits over long-term sustainability	*1*	*K1*	*CO4*
9.	The Sufficiency Economy Philosophy, applied to PSS thinking, promotes____ (a) Overconsumption and rapid growth (b) Moderation, sustainability, and self-reliance (c) Excessive reliance on external resources (d) Short-term profits at the expense of sustainability	*1*	*K1*	*CO5*

10.	The goal of cleaner production is to_____ (a) Increase the environmental footprint of the manufacturing process (b) Reduce resource consumption, waste generation, and emissions in the manufacturing process (c) Focus solely on economic growth with no regard for sustainability (d) Ignore the use of renewable resources to lower production costs		*1*	*K1*	*CO5*

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	Write the Impact of 3D Printing on Product Development.		*2*	*K1*	*CO1*
12.	List out the applications of 3D Printing in Industry4.0.		*2*	*K1*	*CO1*
13.	What is meant by rapid manufacturing?		*2*	*K1*	*CO1*
14.	Define Digitization techniques.		*2*	*K1*	*CO2*
15.	Mention the key factors affecting part orientation.		*2*	*K1*	*CO2*
16.	Distinguish between direct and indirect tooling.		*2*	*K2*	*CO2*
17.	Name two typical process variables in Laser Engineered Net Shaping (LENS).		*2*	*K1*	*CO3*
18.	State two application of Binder Jetting.		*2*	*K1*	*CO3*
19.	How can productivity and sustainability be balanced in industrial processes?		*2*	*K2*	*CO4*
20.	List any four benefits of sustainable development.		*2*	*K1*	*CO4*
21.	Give two examples of sustainable product-service systems.		*2*	*K1*	*CO5*
22.	Define Global Value Creation.		*2*	*K1*	*CO5*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Describe the stages involved in creating a virtual prototype.	*11*	*K2*	*CO1*
		OR			
	b)	Explain any three types of AM processes with suitable diagrams.	*11*	*K2*	*CO1*
24.	a)	Illustrate the step-by-step process of preparing a CAD model for additive manufacturing.	*11*	*K2*	*CO2*
		OR			
	b)	Utilize the principles of design for additive manufacturing to reengineer the mechanical bracket, minimizing weight and material usage while preserving functionality. Incorporate diagrams and justification.	*11*	*K2*	*CO2*
25.	a)	Explain the working principle of Stereolithography Apparatus (SLA)**.** Discuss its process variables, materials used, and typical applications.	*11*	*K2*	*CO3*
		OR			
	b)	Describe the working principle of Wire Arc Additive Manufacturing (WAAM) and discuss the process variables and control challenges.	*11*	*K2*	*CO3*
26.	a)	Describe the transition from traditional design to eco-design to sustainable design.	*11*	*K2*	*CO4*
		OR			
	b)	Explain the role of Life Cycle Assessment in evaluating the environmental impact of products.	*11*	*K2*	*CO4*
27.	a)	Compare and contrast the Khadi Movement's philosophy with the modern PSS approach. How did both focus on sustainability and local economies?	*11*	*K2*	*CO5*
		OR			
	b)	Discuss how the principles of Sufficiency Economy Philosophy (SEP) can be integrated into Sustainable Product-Service System (PSS) design. Provide examples.	*11*	*K2*	*CO5*

28.	a) (i)	Discuss how systems approaches to design can be used to optimize product functionality while reducing its environmental impact.	*6*	*K2*	*CO4*
	(ii)	Explain the strategic importance of shifting to a PSS-based model for businesses aiming for long-term sustainability.	*5*	*K2*	*CO5*
		OR			
	b) (i)	Compare Design for Disassembly (DFD) with Design for Recycling (DFR). Discuss their respective roles in promoting sustainability.	*6*	*K2*	*CO4*
	(ii)	Explain the role of data analytics and smart manufacturing systems in Industry 4.0.	*5*	*K2*	*CO5*