Course Code: 23HS0815 **R23**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY::PUTTUR
(AUTONOMOUS)
Siddharth Nagar, Narayanavanam Road –517583

Subject with Code: DESIGN THINKING & INNOVATION (23HS0815) **Course & Branch:** Common to ALL Engineering branches

Year& Sem: II B.Tech & II Sem **Regulation:** R23

UNIT I

Introduction to Design Thinking

1	a)	What is Design Thinking?	**[L1, CO1]**	**[2M]**
	b)	Name the five stages of the Design Thinking process.	**[L1, CO1]**	**[2M]**
	c)	How is Design Thinking different from traditional problem-solving?	**[L1, CO1]**	**[2M]**
	d)	Who popularized the concept of Design Thinking?	**[L1, CO1]**	**[2M]**
	e)	How does Design Thinking help in product development?	**[L1, CO1]**	**[2M]**
2	a)	Explain the primary focus of traditional thinking.	**[L2, CO1]**	**[5M]**
	b)	How does it differ from the focus of design thinking?	**[L4, CO1]**	**[5M]**
3		Explain the fundamental components of design and their role in visual composition.	**[L2, CO1]**	**[10M]**
4		Demonstrate the principles of design such as balance, contrast, emphasis, and movement, with examples	**[L2, CO1]**	**[10M]**
5	a)	Illustrate the design thinking process and its application in solving complex problems.	**[L2, CO1]**	**[5M]**
	b)	Develop a case study of a successful design thinking project.	**[L3, CO1]**	**[5M]**
6	a)	Explain the importance of empathy in design thinking.	**[L2, CO1]**	**[5M]**
	b)	In what ways can designers utilize empathy to develop effective user-centered solutions?	**[L3, CO1]**	**[5M]**
7		Explain the role of prototyping in design thinking. How can prototyping help designers refine their ideas and create innovative solutions?	**[L2,CO1]**	**[10M]**
8		What is Design Thinking, and how does it influence to problem-solving and innovation?	**[L5, CO1]**	**[10M]**
9		Interpret IDEO and Stanford d.school played a crucial role in developing the Design Thinking framework.	**[L2, CO1]**	**[10M]**
10		Explain the impact of new materials in industrial design and their role in shaping sustainable practices.	**[L2, CO1]**	**[10M]**
11		Illustrate the properties and applications of graphene, nanomaterials, and smart materials. How are these materials transforming various industries?	**[L2, CO1]**	**[10M]**

UNIT II

Design Thinking Process

1	a)	What are the five stages of the Design Thinking process?	**[L1, CO2]**	**[2M]**
	b)	Define the Empathize stage in Design Thinking.	**[L1, CO2]**	**[2M]**
	c)	Why Define stage is important in problem-solving?	**[L1, CO2]**	**[2M]**
	d)	What is the purpose of the Ideate phase?	**[L1, CO2]**	**[2M]**
	e)	How does prototyping help in refining an idea?	**[L1, CO2]**	**[2M]**
2	a)	List and Construct Five stages of Design Thinking process.	**[L3, CO2]**	**[5M]**
	b)	Explain five stages of Design Thinking process with suitable examples.	**[L2, CO2]**	**[5M]**
3		Why is the Empathize stage crucial in Design Thinking, and how does it impact the final solution?	**[L2, CO2]**	**[10M]**
4		Discuss the role of prototyping and testing in refining an idea during the Design Thinking process.	**[L4, CO2]**	**[10M]**
5	a)	List and explain the Design Thinking drive new inventions?	**[L2, CO2]**	**[5M]**
	b)	Choose some examples of innovative products developed using this approach.	**[L4, CO2]**	**[5M]**
6		Demonstrate the essential steps involved in implementing a structured innovation process within an organization?	**[L2, CO2]**	**[10M]**
7		Apply the Design Thinking process to solve social innovation. Provide examples.	**[L3, CO2]**	**[10M]**
8		Discuss a real-world case study where Design Thinking was used for a social innovation.	**[L6, CO2]**	**[10M]**
9	a)	Illustrate about Personas in design thinking.	**[L2, CO2]**	**[5M]**
	b)	Survey the importance of customer journey maps in understanding user experience.	**[L4, CO2]**	**[5M]**
10		Explain the role of brainstorming in the design thinking process.	**[L2, CO2]**	**[10M]**
11		Assess the effectiveness of design thinking in product development with case studies.	**[L5, CO2]**	**[10M]**

Course Code: 23HS0815

R23

UNIT III

Innovation

1	a)	What are the key principles of the art of innovation?	**[L1, CO3]**	**[2M]**
	b)	How does design thinking contribute to innovation?	**[L1, CO3]**	**[2M]**
	c)	What role does risk-taking play in innovation?	**[L1, CO3]**	**[2M]**
	d)	Why is customer-centric thinking important in innovation?	**[L1, CO4]**	**[2M]**
	e)	Compare creativity and innovation.	**[L2, CO4]**	**[2M]**
2	a)	Explain the concept of the art of innovation.	**[L4, CO3]**	**[3M]**
	b)	Demonstrate the key principles of art of innovation.	**[L2, CO3]**	**[7M]**
3		Evaluate the effectiveness of design thinking in driving innovation across its different stages.	**[L5, CO3]**	**[10M]**
4		How do organizations build an innovation-friendly culture? Provide examples.	**[L3, CO3]**	**[10M]**
5		Assess the impact of digital transformation on innovation strategies in leading organizations.	**[L5, CO3]**	**[10M]**
6	a)	Define creativity and innovation with suitable examples.	**[L2, CO3]**	**[5M]**
	b)	Distinguish between creativity and innovation.	**[L4, CO3]**	**[5M]**
7	a)	How do organizations transform creative ideas into innovative solutions?	**[L2, CO3]**	**[5M]**
	b)	Choose some real world examples of creativity leading to innovation.	**[L3, CO3]**	**[5M]**
8		Explain the importance of creativity and innovation in achieving organizational success, with examples.	**[L2, CO4]**	**[10M]**
9		Demonstrate the role of collaboration in the creativity and innovation process. Provide examples.	**[L2, CO4]**	**[10M]**
10		Assess the effectiveness of different metrics used to measure innovation success within organizations.	**[L5, CO4]**	**[10M]**
11		Evaluate the effectiveness of current practices used by companies to measure creativity and innovation outcomes.	**[L5, CO4]**	**[10M]**

Course Code: 23HS0815

R23

UNIT IV

Product Design

1	a)	What is problem formation in product design?	**[L1, CO5]**	**[2M]**
	b)	Define product design and its key components.	**[L1, CO5]**	**[2M]**
	c)	What are the different types of product strategies?	**[L1, CO5]**	**[2M]**
	d)	How does product value impact a company's success?	**[L1, CO5]**	**[2M]**
	e)	What factors influence product planning?	**[L1, CO5]**	**[2M]**
2		Describe the steps involved in problem formation and its importance in product design	**[L2, CO5]**	**[10M]**
3	a)	State product design and List out the different types of product strategies.	**[L1, CO5]**	**[3M]**
	b)	Write the key stages in the product design process.	**[L3, CO5]**	**[7M]**
4		Compare and contrast different product strategies used by companies.	**[L4, CO5]**	**[10M]**
5		Analyze the role of perceived product value in shaping customer perception and market success.	**[L4, CO5]**	**[10M]**
6		Discuss the significance of product planning in ensuring business success.	**[L2, CO5]**	**[10M]**
7	a)	Define product specifications and describe their key components.	**[L2, CO5]**	**[5M]**
	b)	Explain the importance of product specifications in guiding the design and development process.	**[L2, CO5]**	**[5M]**
8	a)	Describe innovation drive product design.	**[L2, CO5]**	**[5M]**
	b)	Identify the key challenges in implementing innovation.	**[L3, CO5]**	**[5M]**
9		Analyze a case study where innovation transformed a product or industry.	**[L4, CO5]**	**[10M]**
10		Describe how sustainability principles can be applied to the design of a common consumer product.	**[L3, CO5]**	**[10M]**
11		Assess the effectiveness of various methods used to measure post-launch product success.	**[L5, CO5]**	**[10M]**

UNIT–V

Design Thinking in Business Processes

1	a)	Define design thinking, and how is it applied in business innovation?	**[L1, CO6]**	**[2M]**
	b)	How does design thinking help businesses solve complex problems?	**[L1, CO6]**	**[2M]**
	c)	What are the key principles of design thinking that redefine businesses?	**[L1, CO6]**	**[2M]**
	d)	Why is empathy important in design thinking for business?	**[L1, CO6]**	**[2M]**
	e)	How can businesses use design thinking to create customer-centric products?	**[L1, CO6]**	**[2M]**
2	a)	Explain the concept of design thinking	**[L2, CO6]**	**[5M]**
	b)	Apply the design thinking process in driving business and strategic innovation.	**[L3, CO6]**	**[5M]**
3	a)	What are the key principles of design thinking that redefine businesses and Provide examples?	**[L2, CO6]**	**[6M]**
	b)	How companies that have successfully implemented design thinking principles.	**[L3, CO6]**	**[4M]**
4	a)	Explain how design thinking helps businesses address growth challenges and improve predictability in their operations.	**[L2, CO6]**	**[6M]**
	b)	Discuss how design thinking supports businesses in maintaining relevance and competitive markets.	**[L2, CO6]**	**[4M]**
5		Compare and contrast the application of design thinking in large organizations versus startups. How does each benefit from this approach?	**[L4, CO6]**	**[10M]**
6		Analyze how design thinking helps businesses navigate extreme competition and adapt to market changes. Provide real-world examples.	**[L4, CO6]**	**[10M]**
7		Businesses often struggle with balancing standardization and innovation. Evaluate How does design thinking provide a solution to this challenge?	**[L5, CO6]**	**[10M]**
8		Make use of design thinking to define and test business models? Explain the process with case studies.	**[L3, CO6]**	**[10M]**
9		Outline the key steps involved in developing and testing a prototype to ensure it meets customer needs and expectations	**[L2, CO6]**	**[10M]**
10		Analyze the elements of a business model created through design thinking, using real-world company examples.	**[L4, CO6]**	**[10M]**
11		Describe the future of design thinking in business and strategic innovation?	**[L2, CO6]**	**[10M]**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY::PUTTUR
(AUTONOMOUS)
Siddharth Nagar, Narayanavanam Road–517583

SubjectwithCode:DESIGN THINKING &INNOVATION(23HS0815)

Course&Branch: Common to ALL Engineering branches

Year& Sem: II B. Tech & II Sem

Regulation: R23

UNIT I

Introduction to Design Thinking

1	a)	**What is Design Thinking?**	**[L1, CO1]**	**[2M]**
		• Design thinking is a human-centered and collaborative approach to problem-solving using a designed mindset to solve complex problems. • It is a nonlinear, iterative process that teams use to understand users, challenge assumptions, redefine problems and create innovative solutions to prototype and test.		
	b)	**Name the five stages of the Design Thinking process.**	**[L1, CO1]**	**[2M]**
		The Five stages of the design thinking process are • Empathy • Define • Ideate • Prototype • Test		
	c)	**How is Design Thinking different from traditional problem-solving?**	**[L1, CO1]**	**[2M]**
		• Design Thinking differs from traditional problem-solving by prioritizing a deep understanding of users' behaviors, emotions, and needs to improve their experience. In contrast, traditional problem-solving often focuses more on technical solutions and logical analysis without a human-centered approach.		
	d)	**Who popularized the concept of Design Thinking?**	**[L1, CO1]**	**[2M]**
		• John Dewey and William Morris laid the foundation for Design Thinking. Its popularity grew through books like The Art of Innovation by Tom Kelley and Change by Design by Tim Brown, which highlighted its role in fostering innovation and transforming organizational culture.		
	e)	**How does Design Thinking help in product development?**	**[L1, CO1]**	**[2M]**
		• Design thinking focusing on understanding and addressing user needs, it helps organizations deliver products and services that resonate with customers, leading to higher levels of satisfaction, loyalty, and advocacy. Customer-centric design can also drive competitive advantage and differentiation in the marketplace.		

2	**a)**	**Explain the primary focus of traditional thinking.**	**[L2, CO1]**	**[5M]**

Traditional thinking

The primary focus of traditional thinking are

1. Focused on the needs of the business
2. Well suited to well-defined technical problems
3. Starts with a problem and builds a solution
4. A linear process
5. Relies on analysis and decision making
6. Relies on critical thinking
7. Rigid and resistant to change.

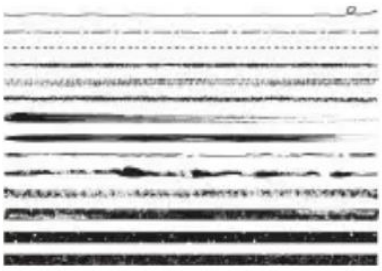
	b)	**How does it differ from the focus of design thinking?**	**[L4, CO1]**	**[5M]**

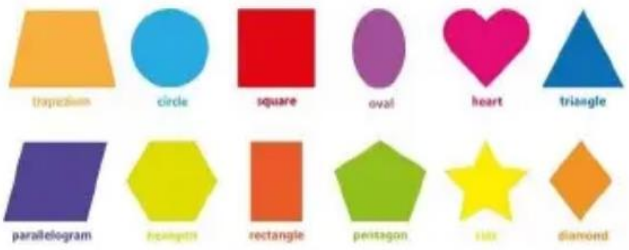
Design thinking	Traditional thinking
1. Goes hand in hand with agile management methods	1. Goes hand in hand with waterfall management methods
2. Relies on creativity, collaboration, and diversity	2. Relies on analysis, decision making, and specialists
3. It's about innovation	3. It's about efficiency
4. Reduces risk by embracing learning and change	4. Often requires large upfront investments
5. Encourages creativity and out-of-the-box thinking	5. Relies on proven methods and solutions
6. It's about making things better for humans	6. It's about making things work
7. Focused on the future	7. Focused on the past or present
8. Explores potential futures	8. Analyzes existing problems
9. Open-ended and fluid	9. Focused and structured
10. Great for new products and services	10. Great for solving specific functional problems

3		**Explain the fundamental components of design and their role in visual composition.**	**[L2, CO1]**	**[10M]**

- The fundamental components of design are **line, shape, form, color, texture, space, and value**. Each of these elements plays a key role in creating a visual composition that is not only aesthetically pleasing but also effective in communicating the intended message.

1. **Dot:**
   - A dot is the visual expression of a point which is an indicator of location. . Theoretically, it has no dimension.
   - It is the simplest and fundamental element of design; all graphic reproduction is based on the smallest unit.
   - It denotes position, point of reference in a space.
2. **Line**
   - A continuous mark made on a surface, such as a stroke in a drawing or boundary in an artwork.
   - Purpose: Creates shapes, directs the eye, and conveys movement or emotion.
   - Examples: Straight, curved, zigzag, dashed, or implied lines.
3. **Shape**
   - A two-dimensional area defined by edges.
   - Types: Geometric (e.g., squares, circles) and organic (freeform, irregular shapes).
   - Purpose: Shapes form the foundation of objects in a design.
4. **Form**
   - A three-dimensional object with volume and depth.
   - Purpose: Adds realism, weight, and dimension to a composition.
   - Example: A cube or sphere in sculpture or digital modeling.
5. **Texture**
   - The surface quality of an object, which can be physical (tactile) or visual (implied).
   - Purpose: Enhances visual interest and evokes sensory responses.
   - Example: Smooth metal, rough wood, or soft fabric.
6. **Color**
   - The aspect of light that is visible to the eye, consisting of hue, value, and intensity.
   - Purpose: Sets mood, emphasizes areas, and creates harmony or contrast.
   - Example: Monochromatic, complementary, or analogous color schemes.
7. **Space**
   - The area around and between objects.
   - Types: Positive space (occupied) and negative space (empty).
   - Purpose: Defines depth, perspective, and relationships between elements.
8. **Value**
   - The lightness or darkness of a color or tone.
   - Purpose: Creates contrast, highlights, and shadows to emphasize form and texture.





4		**Demonstrate the principles of design such as balance, contrast, emphasis, and movement, with examples.**	**[L2, CO1]**	**[10M]**

- The principles of design combine the elements to create a composition, they are the guidelines used to arrange the elements. Each principle is a concept used to organize or arrange the structural elements of a design and it applies to each element of a composition and to the composition as a whole
- Key principles include **balance, contrast, emphasis, movement.** Here's a discussion of some of these principles with examples:

1. Balance

- Balance refers to the visual equilibrium of elements in a design, creating a sense of equality in weight or importance. It can be **symmetrical** (even distribution around an axis) or **asymmetrical** (uneven distribution) and Radial balance.
- **Symmetrical** - when the weight of a composition is evenly distributed around a central vertical or horizontal axis, **Asymmetrical** - when the weight of a composition is not evenly distributed around a central axis) and **Radial Balance** - Elements radiate outward from a central point.
- **Example:** A modern website design where a large image on one side is balanced by a smaller text block on the other.

2. Contrast:

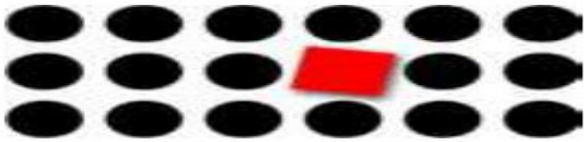
- Contrast is the difference in visualpropertiesthat makes one object distinguishable from other subjects.
- It is often used to emphasize key elements in specific design projects.
- It is used to make elements standout and grab attention.
- Contrast, like proximity, creates a focal point in a visual design.

- **Example:Color Contrast:** Black text on a white background creates high contrast and enhances readability.

Size Contrast

3. Emphasis

- Emphasis is a strategy where the purpose is to draw the viewer s attention to a specific design element.
- It guides the viewer's eye to the most important part of the composition.
- Emphasis therefore, is the component that is the focal point that demands the most attention from the viewer. For an element, form or space to be portrayed as the focal point in a composition or design, it must be made strongly visible.
- **Example**: A website with a large, brightly colored call-to-action button at the center of the page emphasizes that action, making it more noticeable.

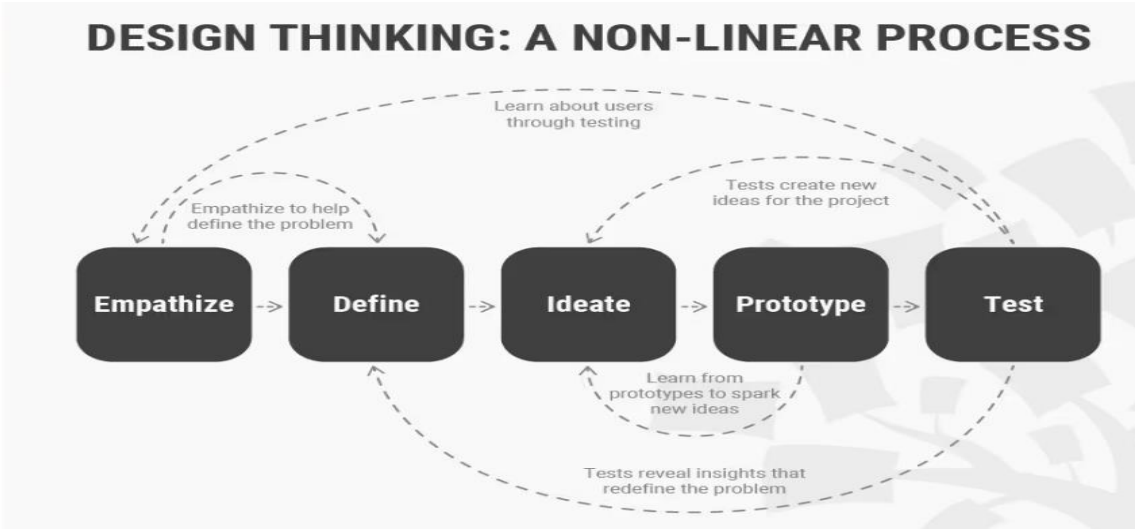


4. **Movement**

- It is the visual flow through the composition, where (depending on the elements placement) the designer can direct the viewer´s eye over the surface of the design.
- The movement can be directed along edges, shapes, lines, color, etc and the purpose of movement is to create unity with eye travel.
- By arranging the composition elements in a certain way, a designer can control and force the movement of the viewer's eyes in and around the composition.
- **Example**: A brochure with a series of arrows or progressive images that lead the viewer's eye from left to right, guiding them through the content step-by-step.

5	**a)**	**Illustrate the design thinking process and its application in solving complex problems.**	**[L2, CO1]**	**[5M]**

- **Design Thinking** is a problem-solving methodology that emphasizes creativity, user-centricity, and collaboration. It helps designers, innovators, and teams develop effective and practical solutions to complex challenges by focusing on understanding the needs of users.
- It involves five key stages: **Empathize**, **Define**, **Ideate**, **Prototype**, and **Test**.
- **Empathize**: Understand the users and their needs through research and observation.
- **Define**: Clearly articulate the problem or challenge to be addressed.
- **Ideate**: Generate creative and innovative ideas to solve the problem.
- **Prototype**: Develop tangible models or mockups of the ideas.
- **Test**: Validate the prototypes by collecting user feedback and iterating as needed.
- Design thinking is most advantageous for organizations and businesses which serve the people's needs.



Applications

- Design thinking has numerous application-based advantages that help a business thrive in the market

1. **It is comprehensive & holistic:**
   - Design Thinking fosters diverse perspectives by involving individuals from various fields, enhancing problem-solving through varied expertise.
2. **It is logical and scientific:**
   - This approach involves understanding user interactions and contexts to uncover innovative solutions through exploration of uncertain elements.
3. **It is non-linear:**
   - The non-linear nature of Design Thinking allows teams to revisit and refine ideas, leading to

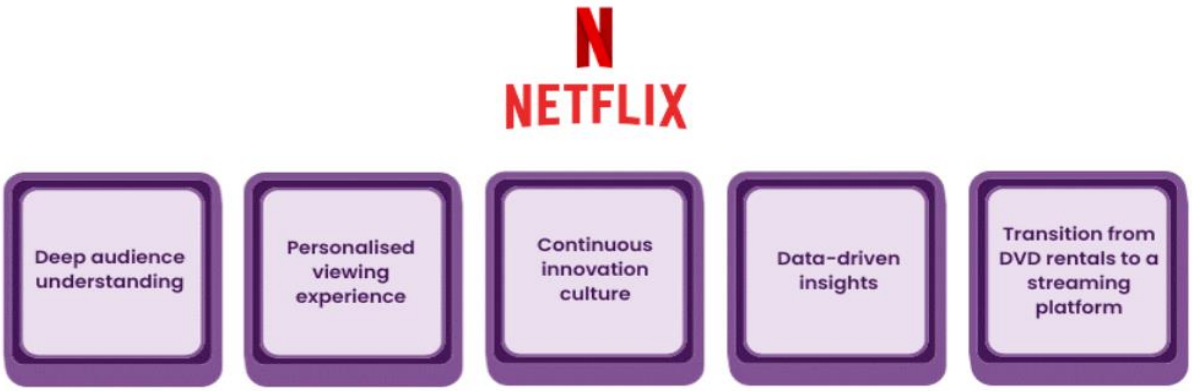
better decisions and new insights.

4. **It is for everyone:**
   - This form of thinking is best-suited for UX/UI companies, freelancers, inventive employees, leaders, managers, and all others who wish to take care of a wide scope of issues.
5. **It empowers testing:**
   - Design thinking suggests performing a wide range of testing for re-examining solutions again and again.

5	**b)**	**Develop a case study of a successful design thinking project.**	**[L3, CO1]**	**[5M]**

Case Study:

Netflix:



- Netflix's success stemmed from using Design Thinking to address customer needs, introducing a subscription model that delivered DVDs directly to homes. This innovation revolutionized the movie rental experience and quickly gained widespread popularity.
- Netflix adapted to changing trends by launching an on-demand streaming service, eliminating physical discs, and focusing on understanding customer desires.
- In 2011, Netflix became a pioneer by producing original content not available on traditional networks. To enhance user experience, it integrated short trailers into its interface in 2016, responding to customer feedback.

6	**a)**	**Explain the importance of empathy in design thinking**	**[L2, CO1]**	**[5M]**

Importance of empathy in design thinking

		• In a social context, empathy is often what drives us to take action • If we see people suffering or struggling, and we are able to empathize with their situation, we are compelled to help relieve them in some way. • Designers need to build empathy for their users in order to take the right course of action. • It's important to understand how the user feels when interacting with a certain product or interface; does the layout of this website evoke feelings of frustration? • In building empathy, designers can create products which truly please the user and make their lives easier • Without this empathy, the design process lacks that all-important user centricity which often marks the distinction between product success and failure. • Empathizing ensures that designers aren't operating in a vacuum or assuming they know what the user wants. • It builds a comprehensive understanding of the user's experience, which is essential for developing solutions that are relevant, impactful, and meaningful.		
6	**b)**	**In what ways can designers utilize empathy to develop effective user-centered solutions?**	**[L3, CO1]**	**[5M]**
		<u>Designers use empathy to create user-centered Designs</u> • **Conducting User Research:** Designers gather information through interviews, observations, and surveys to understand user behaviors and challenges. • **Creating Personas:** They develop fictional characters that represent different user types to guide design decisions. • **Mapping User Journeys:** Designers visualize the steps users take when interacting with a product or service to identify pain points and opportunities. • **Immersive Experience:** Sometimes, designers directly experience the users' environment or tasks to gain first-hand understanding. • **Testing and Feedback:** Designers continuously test prototypes with users to collect feedback and improve designs based on real user experiences.		
7		**Explain the role of prototyping in design thinking. How can prototyping help designers refine their ideas and create innovative solutions?**	**[L2,CO1]**	**[10M]**
		• One of the key aspects of prototyping is that it generates empathy for prospective consumers. In this respect, designing software or designing products for human use are not much different. Any product designed without understanding the customer's needs can result in unnecessary		

features, poor designs, and a host of problems. With prototyping, you can enjoy various benefits like:

1.Evaluate Technical Feasibility

- Creating a prototype makes it possible to concretize an idea and assess which features pose difficulty in implementation. Prototyping can thus identify unanticipated physical, technical, or financial constraints.

2.Enhance Website Quality

- A well-designed prototype will enable you to:
- Conduct testing for site usability
- Inspect site navigation
- Conveniently access information on the site
- Determine correct placement of visual accents – what visitors should see first

3.Effectively Present Idea to Customers

- Prototyping makes it possible to present your future product to potential customers before the actual launch of the product. It could also allow you to devise your marketing strategies better and start pre-sales.

4.Reduced Risks

- Projects with a complete prototyping process are at lower risk than projects without prototyping. This is because prototyping directly affects project resources, time, and budget.

5.Iterate at Lower Costs

- Information gathered from potential customers through prototyping makes it possible to improve the product until an optimal product is formulated. A good idea can be to create several prototypes before the launch of mass production so that the additional costs of unsold products and reprogramming can be curtailed.

6.Simulate the Future Product

- The most important advantage of prototyping is that it creates a model of the final product. It can help lure customers to invest in the product prior to any resource allocation for implementation. You can discover design errors and check their correctness before going into production.

7.Provide Focused Feedback

- Exposing the prototype helps to get focused customer feedback on the desired qualities in the product. This feedback is critical to understand the needs and expectations of users, business

requirements and gain a clear idea of what the product is headed for.

8. Planning

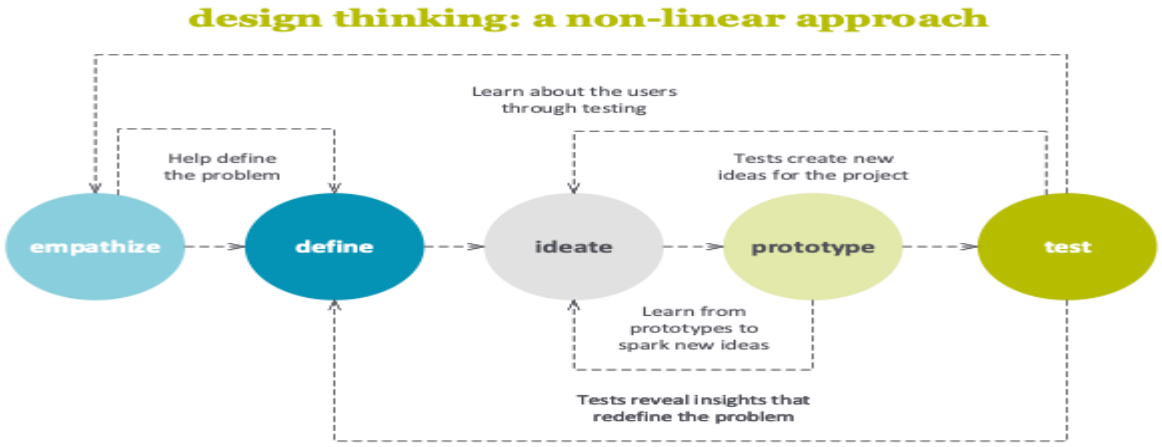
- Through prototyping, the design team gets essential information that helps them to plan out the implementation. A prototype helps build user stories and emphasize on user needs. This brings substantial benefits to the scrum teams.

9.Quick and Easy

- A designer can quickly develop a ready-to-implement prototype even from a simple idea on paper if they understand the logic and functionality of the product.

8		**What is Design Thinking, and how does it influence to problem-solving and innovation?**	**[L5, CO1]**	**[10M]**

Design thinking is a human-centered and collaborative approach to problem-solving using a designed mindset to solve complex problems.It is a nonlinear, iterative process that teams use to understand users, challenge assumptions, redefine problems and create innovative solutions to prototype and test.



How Design Thinking Contributes to Problem-Solving and Innovation:

1. Human-Centric Approach:

- Design Thinking emphasizes understanding the needs and behaviors of the users or stakeholders involved in a problem. This allows teams to identify problems that truly resonate with people and create solutions that are meaningful and effective.

2. Iterative and Flexible:

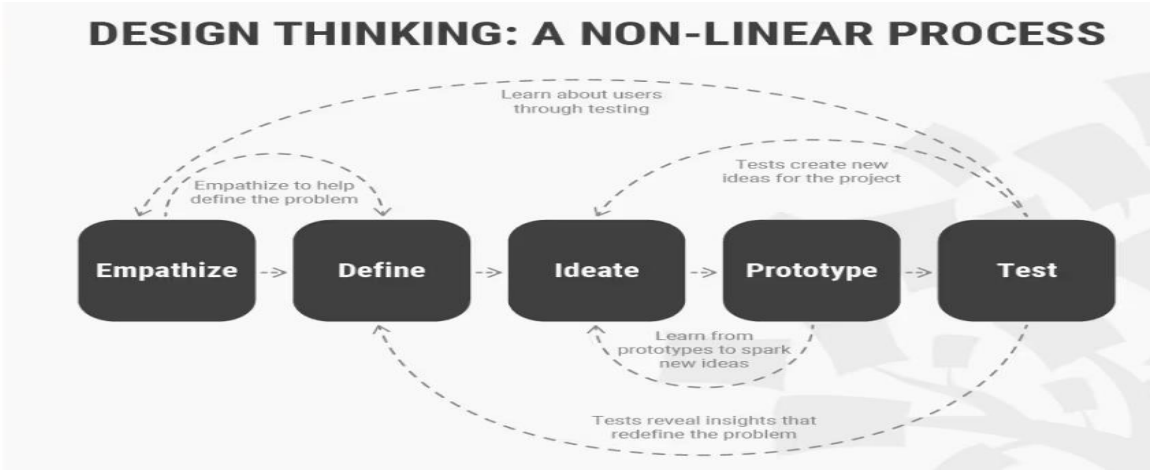
		• Design Thinking is a non-linear process that involves cycles of prototyping, testing, and refining solutions based on user feedback. This allows teams to adapt and evolve their ideas as they learn more about the problem and its context. 3. **Creative Problem-Solving:** • By encouraging teams to explore a wide range of potential solutions, Design Thinking promotes creative thinking and innovation. It helps teams think outside the box and challenge assumptions to find innovative ways to address complex problems. **4. Improved User Experience:** • Design Thinking focuses on creating solutions that meet the needs and expectations of users. This leads to products, services, and processes that are not only functional but also user-friendly and enjoyable. **5. Reduced Risk and Uncertainty:** • By engaging users in the problem-solving process and testing solutions through prototyping, Design Thinking helps to reduce the risk of developing products or services that are not well-received. **6. Increased Innovation:** • Design Thinking encourages teams to think creatively and explore new possibilities, leading to more innovative solutions and products. It helps organizations stay ahead of the curve and adapt to changing market conditions. **7. Better Business Outcomes:** • By focusing on user needs and iteratively improving solutions, Design Thinking can lead to increased customer satisfaction, reduced costs, and improved business performance.		
9		**Interpret IDEO and Stanford d.school played a crucial role in developing the Design Thinking framework.**	**[L2, CO1]**	**[10M]**
		• Stanford University's d.school (Hasso Plattner Institute of Design) has been a leading advocate for integrating design thinking into higher education and expanding scholarship opportunities. • Closely aligned with IDEO's design thinking model, the d.school emphasizes **empathy-driven problem solving**, **collaboration**, and **experiential learning**. • Its design model promotes the use of **multidisciplinary teams**, engaging students in hands-on projects such as design contests to foster creative thinking. • The d.school's process typically follows phases like **empathizing, defining, prototyping, and testing**, with a strong focus on **reframing problems** and **co-creating innovative solutions**. • IDEO, a globally renowned design and consulting firm, played a foundational role in bringing		

design thinking to prominence. IDEO's approach is inherently **multidisciplinary**, encouraging teams composed of individuals with varied skill sets to collaborate on solving complex problems.

- The firm helped structure the now widely adopted design thinking framework—**Empathize, Define, Ideate, Prototype, and Test**—and championed **rapid iteration** and **user feedback** to refine ideas and create impactful solutions.
- Through this process, IDEO demonstrated the power of design thinking in creating products, services, and systems that are both functional and user-centered.

IDEO's Human-Centered Design Approach

- IDEO's human-centered design approach prioritizes users in problem-solving by emphasizing empathy, collaboration, and iterative prototyping.
- By immersing themselves in users' experiences,IDEO designers gain insights into their needs and behaviors, leading to innovative solutions that resonate with users.
- Empathy allows for a deeper understanding of challenges and desires, while collaboration ensures diverse perspectives inform the design process. Through iterative prototyping and continuous user feedback, IDEO refines solutions to create products and services that are not only functional but deeply connect with users globally, revolutionizing the design industry.



Key Insights

- Prioritized empathy in problem-solving transformed innovation processes.
- Introduced dynamic ideation methods for creative solutions.
- Emphasized user-centricity for resonant and impactful designs.
- Fostered diverse perspectives for innovative outcomes.
- Led the mainstream acceptance of design thinking as a transformative tool.

10		**Explain the impact of new materials in industrial design and their role in shaping sustainable practices.**	**[L2, CO1]**	**[10M]**

These new materials offer improved performance, sustainability, and efficiency. Here are some of the notable ones:

1. Graphene

Properties: Extremely strong, lightweight, and conductive.

Applications: Electronics, energy storage (batteries, capacitors), composites, and medical devices.

2. Carbon Fiber Composites

Properties: High strength-to-weight ratio, durable, corrosion-resistant.

Applications: Aerospace, automotive, sports equipment, and construction.

3. Aerogels

Properties: Ultra-light, high thermal insulation, low density.

Applications: Insulation in spacecraft, construction, and high-performance coatings.

4. Biodegradable Plastics (e.g., PLA, PHA)

Properties: Environmentally friendly, compostable, and renewable.

Applications: Packaging, medical products, and agriculture.

5. Smart Materials (e.g., Shape Memory Alloys, Piezoelectric Materials)

Properties: Can change properties in response to external stimuli (temperature, stress, or electric fields).

Applications: Actuators, sensors, robotics, and medical devices.

6. Self-Healing Materials

Properties: Materials that can repair damage automatically.

Applications: Coatings, concrete, polymers, and aerospace components.

7. Nanomaterials

Properties: Enhanced strength, electrical, and thermal conductivity at the nanoscale.

Applications: Electronics, energy, medicine (drug delivery), and environmental remediation.

8. High-Performance Ceramics

Properties: Resistant to high temperatures, corrosion, and wear.

Applications: Aerospace, automotive, medical implants, and electronics.

9. 3D Printing Materials (e.g., Metal Alloys, Photopolymers)

Properties: Customizable, highly precise, can create complex structures.

Applications: Rapid prototyping, manufacturing, medical implants, and aerospace.

10. Transparent Aluminum

		Properties: Stronger and lighter than glass, transparent. **Applications**: Armor, windows, lenses, and aerospace components		
11		**Illustrate the properties and applications of graphene, nanomaterials, and smart materials. How are these materials transforming various industries?**	**[L2, CO1]**	**[10M]**
		1. Graphene **Properties**: • Ultra-strong (200 times stronger than steel) • Extremely light and flexible • Excellent conductor of heat and electricity • Transparent • High surface area **Applications**: • Electronics, energy storage (batteries, capacitors), composites, and medical devices. **2. Nanomaterials** **Properties:** 1. Materials with structures at the nanoscale (1–100 nm) 2. Often exhibit unique optical, electrical, and mechanical properties compared to their bulk counterparts 3. High surface-to-volume ratio, enhancing reactivity and strength 4. Tunable properties based on size, shape, and composition **Applications:** • Medicine, electronics, environmental protection (filtration, pollution control), and energy (solar cells, batteries). **3. Smart Materials** **Properties:** • Materials that respond to external stimuli such as heat, pressure, electricity, or light • Can change shape, color, stiffness, or conductivity • **Examples:** include shape-memory alloys, piezoelectric materials, electro chromic materials, and thermo chromic materials **Applications** • Architecture, healthcare (medical devices), wearable technology (smart fabrics), and automotive/aerospace (self-healing coatings, lightweight composites). **Graphene, nanomaterials, and smart materialsare transforming various industries**		

		• **Electronics:** Faster, smaller, and efficient devices; used in sensors and quantum computing. • **Energy:** Efficient storage, renewable energy solutions, energy harvesting(Improved batteries, super capacitors, and solar cells; better energy distribution) • **Healthcare:** Targeted drug delivery, diagnostics, medical implants, and smart prosthetics. • **Construction:** Self-healing materials, energy-efficient buildings, and precise manufacturing. • **Aerospace/Automotive:** Lightweight, strong materials for fuel efficiency and safety.

UNIT-II QUESTION WITH ANSWERS

DESIGN THINKING PROCESS

1	a)	**What are the five stages of the Design Thinking process?**	**[L1,CO2]**	**[2M]**

Ans:

The Design Thinking process involves five stages:

1.Empathize
2.Define
3.Ideate
4.Prototype
5.Test

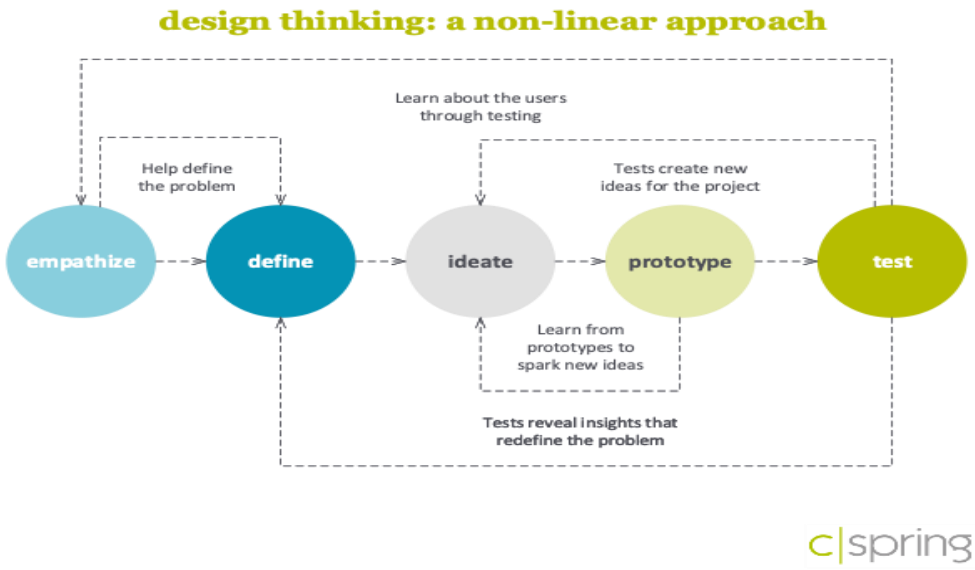


Fig.stages of the Design Thinking process

	b)	**Define the Empathize stage in Design Thinking.**	**[L1,CO2]**	**[2M]**

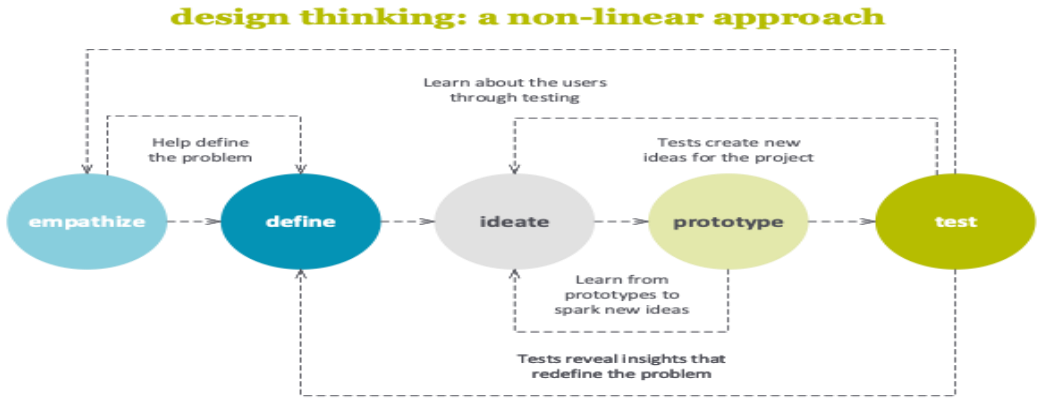
Ans:

- In the Empathize stage, designers immerse themselves in the world of their users to understand their needs, behaviors, pain points, and emotions. By engaging with users through interviews, observations, and immersive experiences, designers gather insights that are critical for addressing the right problem.

	c)	**Why Define stage is important in problem-solving?**	**[L1,CO2]**	**[2M]**

Ans:

- The Analyze (Define) stage is crucial in problem-solving because it helps clearly understand the problem before trying to solve it.
- This stage involves identifying the root cause, defining the scope, and setting clear objectives. Without a proper definition, efforts might be wasted on solving the wrong issue or applying

	ineffective solutions. It lays the foundation for focused, efficient, and effective problem-solving.			
	d) What is the purpose of the Ideate phase?		**[L1,CO2]**	**[2M]**
	Ans: • The Ideate stage is the third phase in the Design Thinking process and it is considered for both exciting andchallenging**.** In this stage, creativity flows**,** and divergent thinking takes place to generate a wide range of ideas, without immediately judging their feasibility (or) practicality.			
	e) How does prototyping help in refining an idea?		**[L1,CO2]**	**[2M]**
	Ans: • Prototyping helps refine an idea by turning abstract concepts into tangible models that can be tested and evaluated. It allows for early detection of defects, gathering user feedback, and exploring different design options. • This iterative process helps improve the idea based on real-world input, making the final solution more effective and user-friendly.			
2	**a) List and Construct Five stages of Design Thinking process.**		**[L3,CO2]**	**[5M]**
	Ans: • The **Design Thinking** process is a human-centered approach to innovation that focuses on understanding the user's needs, challenges, and experiences to come up with creative solutions. • The process is iterative and It typically involves five stages, such as 1. Empathize 2. Define 3. Ideate 4. Prototype 5. Test  			

2	**b) Explain five stages of Design Thinking process with suitable examples.**	**[L2, CO2]**	**[5M]**

1. Empathize

- **Understanding and share the feelings of** users by observing and engaging with them to grasp their experiences and needs.
- **Examples:** In marketing, empathizing could mean studying customer behavior, conducting focus groups, or analyzing customer feedback to better understand their needs and desires.

2. Define

- Clearly articulate the problem based on insights gained from the empathize stage, framing it in way that is focused on user needs
- **Example:** In marketing, the problem might be defined as: "Customers are not fully aware of the new features in our product, leading to lower engagement and sales."

3. Ideate

- Generate a **wide range of ideas and potential solutions** through **brainstorming and creative** thinking, aiming for quantity and diversity.
- **Example:** In marketing, the team might come up with ideas like launching a targeted email campaign, creating tutorial videos, or offering limited-time promotions to raise awareness on new product features.

4. Prototype

- Create tangible, low-fidelity representations of ideas to explore their feasibility and gather feedback. This helps in visualizing and testing concepts.
- **Example:** Marketing might develop a prototype of a new website landing page or a mock-up of an email campaign to test how well the message resonates with the target audience.

5. Test

- Evaluate prototypes with users to gather feedback and learn what works and what needs improvement, leading to further refinement.

Example: Marketing could A/B test the email campaign or landing page with a segment of the customer base to determine which version leads to higher engagement and conversions.

3	**Why is the Empathize stage crucial in Design Thinking, and how does it impact the final solution?**	**[L2,CO2]**	**[10M]**

Ans:

<u>Empathize Stage is Crucial in design thinking</u>:

- The **Empathize stage** is the ability to share someone else's feelings or experiences by imagining what it would be like to be in their situation.
- This stage is **crucial for understanding user needs**, allowing designers to deliver more **personalized and relevant solutions**.
- It serves as the **cornerstone of any successful design project**.
- The extent to which you understand and empathize with your users **ultimately shapes the outcome** of your design.
- The main objective is to uncover **latent or unarticulated user needs and behaviors** that users themselves may not express directly.
- Empathic research and design**is not concerned with facts about the user**, such as the age their age or location
- Rather it focus on their **feeling towards a product and their motivations** in certain situations

Empathize Impacts the Final Solution:

1. **Aligns Solutions with Real Needs**
   - Empathy ensures that the final product addresses **actual user problems**, not just assumed ones
2. **Enhances User Satisfaction**
   - By understanding user emotions and motivations, the solution becomes more **user-centric, intuitive, and impactful.**
3. **Drives Innovation**
   - Identifying deep, unspoken user needs enables the creation of **innovative solutions** that go beyond what users explicitly request.
4. **Reduces Risk of Failure**
   - Products designed without empathy often **fails to meet user needs**, increasing the **risk of costly redesigns or market failure.**

4	**Discuss the role of prototyping and testing in refining an idea during the Design Thinking process.**	**[L4,CO2]**	**[10M]**

Ans:

- Prototyping and testing are crucial steps in the Design Thinking process, transforming abstract ideas into refined solutions that address user needs. These stages help validate concepts, identify hidden issues, and ensure the final product meets user expectations.

Role of Prototyping:

1. **Bring Ideas to Life**
    - Prototypes are **tangible representations** of ideas, allowing abstract concepts to be explored in real-world contexts.
2. **Encourage Experimentation**
    - They allow teams to **explore multiple versions** of a solution quickly and cost-effectively.
3. **Reveal Hidden Challenges**
    - Prototypes often expose unforeseen issues, such as usability problems or design flaws, that weren't apparent during the brainstorming phase.
4. **Facilitate user Feedback**
    - Prototypes offer something tangible for users to interact with, making feedback more specific and actionable, helping designers fine-tune the solution.

Role of Testing:

1. **Validate Assumptions**
    - Testing determines whether a solution **actually meets user needs** and behaves as expected in real scenarios.
2. **Refine and Improve**
    - Based on user feedback, teams can **iterate and enhance** the prototype, moving closer to an optimal solution.
3. **Reduce Risk**
    - Early testing identifies problems before full-scale implementation, saving **time, money, and resources**.
4. **Empower User-Centric Design**
    - It ensures the final product is **shaped by real user input**, not just assumptions or internal opinions.

5	**a) List and explain the Design Thinking drive new inventions?**	**[L2, CO2]**	**[5M]**

Ans:

Design Thinking Fuels Invention:

1. **Empathy Uncovers Real Problems:**
    - By deeply understanding users' behaviors, challenges, and emotions, inventors can identify

	pain pointsthat others overlook. 2. **Reframing Sparks Fresh Ideas:** • Design Thinking encourages reframing problems in ways that lead to **novel, user-centered solutions**, not just fixes. 3. **Rapid Prototyping Enables Quick Experimentation:** • Instead of waiting to perfect an idea, quick testing helps **learn fast and fail forward**, fueling invention through real-world insights. 4. **Cross-functional Collaboration:** • Diverse teams contribute a range of perspectives, often leading to breakthrough ideas that wouldn't arise in isolated or uniform settings.		
5	**b) Choose some examples of innovative products developed using this approach.**	**[L4, CO2]**	**[5M]**
	Examples of Innovative Products from Design Thinking: **1. Airbnb** • **Problem:** Travelers struggled to find affordable, local accommodations. • **Design Thinking Impact:** The founders stayed in hosts' homes to understand both guest and host pain points. They redefined the travel experience—not just lodging—resulting in Airbnb's revolutionary peer-to-peer platform. **2. Apple iPod & iPhone** • **Problem:** People wanted better ways to enjoy music and communicate. • **Design Thinking Impact:** Apple's design team, led by a deep focus on **user experience**, created sleek, intuitive devices. The iPod redefined music; the iPhone revolutionized communication. **4. IDEO Shopping Cart (ABC Nightline Challenge)** • **Problem:** Shopping carts were unsafe and difficult to maneuver. • **Design Thinking Impact:** IDEO applied Design Thinking in a public design challenge, quickly prototyping a new cart with safety features, modular storage, and theft deterrents—showing the power of user-centered design under pressure.		
6	**Demonstrate the essential steps involved in implementing a structured innovation process within an organization?**	**[L2,CO2]**	**[10M]**
	Ans: **<u>Implementing the process in driving inventions</u>** • Implementing a process to drive innovation involves creating a structured framework that encourages		

the generation, development, and implementation of creative ideas. Here is a step-by-step guide to implementing an innovation process within an organization:

1. **Establish a Culture of Innovation**:
   - Foster an environment that values creativity, experimentation, and risk-taking. Encourage open communication, diverse perspectives, and a willingness to challenge the status quo.
2. **Define Clear Objectives and Goals**:
   - Determine the specific areas or aspects of the organization where innovation is most needed. Clearly articulate the goals and outcomes you hope to achieve through the innovation process.
3. **Identify Innovation Champions:**
   - Appoint individuals or teams responsible for driving the innovation process. These champions should be passionate about innovation and have the skills to facilitate creative thinking.
4. **Understand Customer Needs and Market Trends:**
   - Conduct market research and engage with customers to understand their pain points, preferences and emerging trends. This insight will guide the direction of your innovation efforts.
5. **Idea Generation:**
   - Encourage employees at all levels to contribute ideas. Provide platforms for brainstorming sessions, idea contests, suggestion boxes, and collaborative workshops. Emphasize diversity of thought.
6. **Idea Evaluation and Prioritization:**
   - Establish criteria for evaluating and prioritizing ideas. Consider factors such as feasibility, market potential, alignment with organizational goals, and resource requirements.
7. **Prototype and Testing:**
   - Develop prototypes or proofs of concept for selected ideas. This allows for practical testing and refinement before full-scale implementation.
8. **Allocate Resources:**
   - Provide the necessary resources, including funding, time, and expertise, to support the• development and implementation of innovative ideas.
9. **Create Cross-Functional Teams:**
   - Form multidisciplinary teams that bring together individuals with diverse skills and expertise. This promotes a holistic approach to problem-solving and innovation.
10. **Encourage Collaboration and Knowledge Sharing:**
   - Foster a collaborative work environment where employees freely exchange ideas and insights. Use platforms like intranets, team meetings, and collaboration tools to facilitate communication.

	11. Feedback and Iteration: • Solicit feedback from stakeholders, including employees, customers, and partners. Use this feedback to refine and improve the innovation process for ongoing success.		
7	**Apply the Design Thinking process to solve social innovation. Provide examples.**	**[L3,CO2]**	**[10M]**

Ans:

- Design thinking plays a crucial role in social innovation by providing a human-centered approach to addressing complex social problems. Here are some ways design thinking contributes to social innovation

1. **Empathizing with the Community**
   - Design Thinking starts with **understanding the needs, desires, and pain points** of the community.
   - By putting themselves in the users' shoes, social innovators create **empathy-driven solutions** that tackle the root causes of social issues.
2. **Ideation and Prototyping**
   - It encourages **generating a broad range of innovative solutions** to tackle social problems.
   - Through **prototyping and testing**, ideas are refined to improve effectiveness and identify potential challenges early.
3. **Collaboration and Co-Creation**
   - Design Thinking facilitates **multi-stakeholder collaboration** with community members, organizations, and governments.
   - It promotes **co-creation**, ensuring solutions are **community-driven**, sustainable, and tailored to local needs.
4. **Scalability and Sustainability**
   - It helps create **scalable solutions** that can be replicated across different regions or communities.
   - The focus on long-term sustainability ensures that solutions remain effective over time.

Examples of Design Thinking in Social Innovation

- **Financial inclusion:** Using design thinking to create **innovative financial services** for low-income communities.
- **Education**: Developing **interactive, engaging programs** to improve learning outcomes for underserved students.
- **Healthcare**: Creating **user-centered healthcare solutions** for vulnerable populations.

By applying design thinking principles, social innovators can develop more effective, sustainable, and community-owned solutions to complex social problems:

Some real-world examples:

- **Poverty**: IDEO.org used Design Thinking in Kenya to co-create financial tools with low-income communities.
- **Education**: The Stanford d.school helped develop creative learning environments that address different learning styles.
- **Healthcare**: In India, Aravind Eye Care redesigned cataract surgery processes to reduce costs while maintaining quality, making care accessible to millions.

8	**Discuss a real-world case study where Design Thinking was used for a social innovation.**	**[L6,CO2]**	**[10M]**

Ans:

Case Study: Embrace – Affordable Infant Warmer

Challenge

- Premature and low-birth-weight babies in developing countries often die due to **hypothermia**, especially in rural areas where access to incubators is limited or nonexistent. Traditional incubators cost up to $20,000—far too expensive for many hospitals in low-resource settings.

The Design Thinking Approach:

1. Empathize:

A team of Stanford d.school students went to Nepal and India to understand the problem firsthand. They visited rural clinics, hospitals, and homes, speaking with doctors, nurses, and mothers.

- **Key Insight**: Most mothers couldn't reach hospitals, and babies were being born at home or in rural clinics with no access to electricity or high-tech devices.
- The real need wasn't a cheaper incubator, but something **portable, low-cost, and easy to use without power**.

2. Define

- The team reframed the problem:
- "How might we create a way to keep premature infants warm in remote areas, where resources and electricity are limited?"

3. Ideate

They brainstormed a wide range of ideas, from insulated blankets to battery-operated heating devices.

- Prioritized **low-cost**, **simplicity**, and **scalability**.
- Thought about how caregivers with little or no medical training could use it.

4. Prototype

The team developed a prototype of a **sleeping-bag-like infant warmer** using a **phase-change material** that could be heated with boiling water and maintained a constant temperature for hours.

- It could be reused, sterilized, and didn't require electricity.
- The product was called **Embrace**.

5. Test

They tested the product with clinics and mothers in India. Feedback helped refine the design: making it more intuitive, safer, and more durable.

Impact

- **Cost**: Around $25 compared to $20,000 for a traditional incubator.
- **Reach**: Embrace has helped over **300,000 low-birth-weight and premature infants** across more than 20 developing countries.
- **Awards**: The innovation received global recognition, including praise from the WHO and the Clinton Global Initiative.

9	**a) Illustrate about Personas in design thinking.**	**[L2,CO2]**	**[5M]**

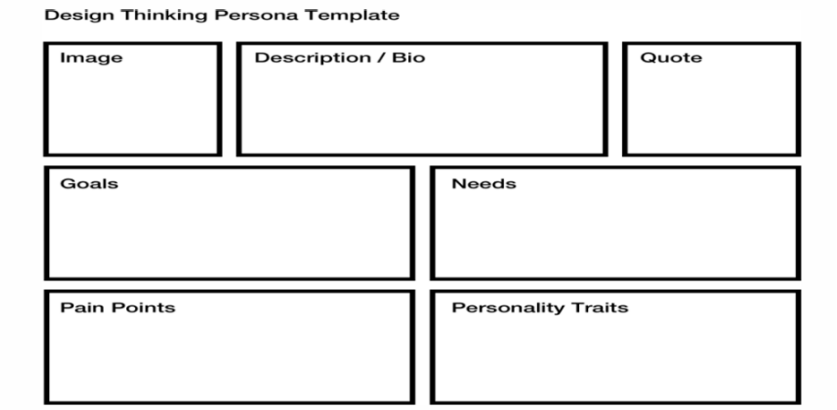
Ans:

<u>Personas in Design thinking</u>

- **Personas** are fictional characters, which you create based upon your research in order to represent the different user types that might use your service, product, site or brand in a similar way.
- Creating person will help you
  - ❖ To understand user your user's needs, experiences, behaviours and goals.
  - ❖ To recognize the different people have different needs and expectations.
  - ❖ To identify with the user you are designing for.
- In the design thinking process, designers will often start creating personas during the second phase, the define phase.
- In the defined phase, design thinkers synthesize their research and findings from the very first

phase, the empathize phase.

- Using personas is just one method, among others, that can help designers move on to the third phase. Ideation phase.'
- The personas will be used as a guide for ideation sessions such as brainstorm, story boarding



Key Elements of Personas:

- Name and photo (to humanize them)
- Age, job, location
- Goals and motivations
- Frustrations and pain points
- Behaviors and tech usage
- Quotes or insights from real users

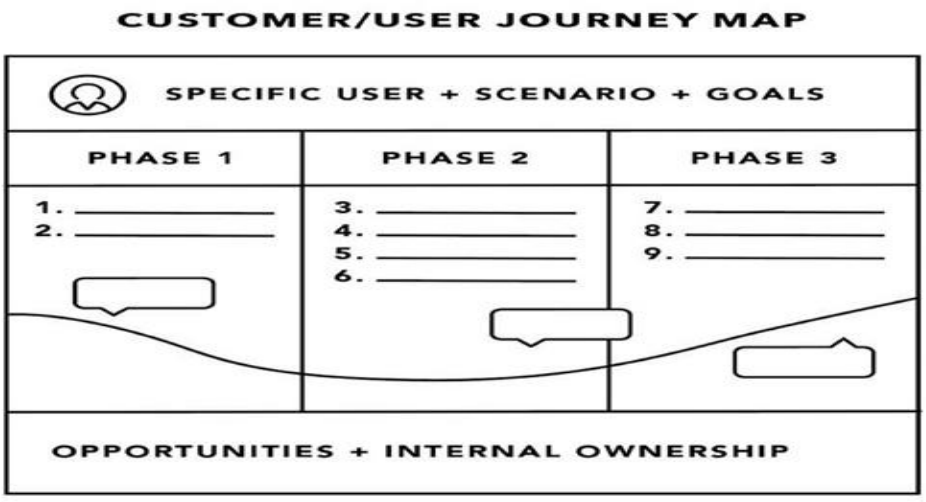
9	**b) Survey the importance of customer journey maps in understanding user experience.**	**[L4, CO2]**	**[5M]**

<u>The importance of customer journey map</u>

- A customer journey maps is the visual representation of the customer journey (also called the buyer journey or user journey).
- CJM is a visualization of the process that a person goes through accomplish a goal tied to a specific business or product or service
- It helps you tell the story of yours customers' experiences with your brand across all touch points.
- CJM is important, because it is a strategic approach to better understanding customer expectations and is crucial for optimizing the customer experience.
- CAM is just important for small and medium-sized enterprises as it is for large companies.
- Allowing you to optimize the customer on boarding process.
- Benchmarking the customer experience desired by your customers against what that actually

receives.

- Creating a logical order to your buyer journey.



Key Elements of Journey Mapping

- Customer Perspective
- Touch points
- Emotional Journey
- Pain Points
- Opportunities for Improvement

10	**Explain the role of brainstorming in the design thinking process.**	**[L2,CO2]**	**[10M]**

Ans:

- Brainstorming in Design Thinking Brainstorming is an invaluable cog within the Design Thinking machinery. By creating an open environment where multiple ideas are encouraged and heard, Brainstorming facilitates the progression of the Design Thinking process.

1. **Gathering varied perspectives**
   - Design Thinking thrives on collaboration, drawing insights from diverse stakeholders.

Brainstorming fuels innovation by bringing together varied perspectives to explore a wide range of potential solutions.

2. **Nurturing creativity**
   - Creativity is central to Design Thinking, and brainstorming nurtures it by encouraging open, non-judgmental idea sharing. This collaborative energy sparks unique solutions and fosters a sense of ownership and engagement among participants.
3. **Fostering innovation**
   - Brainstorming fosters innovation in Design Thinking by enabling risk-taking and the free flow of ambitious ideas. It transforms user insights into a wide range of potential solutions, laying the foundation for prototyping and testing.
4. **Building empathy**
   - Brainstorming in Design Thinking helps build empathy by encouraging open sharing and deeper understanding of diverse perspectives. This enables teams to view problems through the users' eyes, leading to more user-centered solutions.
5. **Encouraging collaboration and team building**
   - Brainstorming fosters collaboration and unity by treating all ideas with equal importance, dissolving hierarchies, and encouraging open dialogue. It enhances team cohesion as members actively engage, share, and build upon one another's ideas toward a common objective.
6. **Facilitating problem-solving**
   - Brainstorming in Design Thinking foster the creativity by encouraging diverse solutions and shifting perspectives, allowing teams to explore new angles and identify previously overlooked solutions.

11	**Assess the effectiveness of design thinking in product development with case studies.**	**[L5,CO2]**	**[10M]**

Ans:

Importance of Design Thinking in Product Development

- **User-Centric Approach**: Focuses on solving real customer problems.
- **Innovative Solutions**: Encourages creativity and out-of-the-box thinking.
- **Rapid Prototyping**: Reduces time and cost of development.
- **Iterative Improvement**: Enhances product quality through continuous feedback.
- **Business Impact**: Leads to higher customer satisfaction and market success.

Case Study Example:

1. Apple iPhone Apple's iPhone development followed design thinking principles:

- **Empathy:** Understanding user frustrations with existing mobile phones.
- **Define:** The problem was complex user interfaces and lack of intuitive design.
- **Ideate:** Brainstorming touch screen UI, app ecosystem, and simple design.
- **Prototype:** Early iPhone prototypes were tested for usability.
- **Test & Implement**: Refined product before launch, leading to a revolutionary Smartphone.

2**. Tesla - Innovation in Electric Cars**

❖ **Challenge:**

- Traditional electric vehicles (EVs) had limited range, slow charging times, and was not widely adopted.

❖ **Design Thinking Approach:**

- **Empathy:** Tesla conducted market research and found that consumers wanted high-performance, stylish, and long-range EVs.
- **Define:** The key issues were battery efficiency, charging infrastructure, and vehicle design.
- **Ideate**: Tesla brainstormed high-capacity battery packs, supercharging stations, and an advanced driving experience.
- **Prototype:** Tesla tested battery performance, aerodynamics, and software for its Model S. Test & Implement: After multiple iterations, Tesla successfully launched an EV with long range, fast charging, and smart features.
- **Outcome:** Tesla revolutionized the automotive industry by making EVs desirable, practical, and high performance, leading to global adoption.

Course Code: 23HS0815 **R23**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY::PUTTUR
(AUTONOMOUS)
Siddharth Nagar, Narayanavanam Road–517583

Subject with Code: DESIGN THINKING & INNOVATION (23HS0815) **Course &Branch:** Common to ALL Engineering branches

Year& Sem: II B. Tech & II Sem **Regulation:** R23

UNIT III

INNOVATION

1	a)	**What are the key principles of the art of innovation?**	**[L1, CO3]**	**[2M]**
		The key principles of the art of innovation are: • Be action oriented (Creativity + Execution) • Risk-Taking and Experimentation • Problem-Solving and Value Creation • Collaboration and Cross-Disciplinary Thinking • Start small • Adaptability and Flexibility • Customer-Centricity • Persistence and Long-Term Vision • Continuous Learning		
	b)	**How does design thinking contribute to innovation?**	**[L1, CO3]**	**[2M]**
		• It helps innovators create better products, services, or solutions by deeply understanding the needs of users and focusing on solving real problems in a practical and human-centered way. • By using design thinking, organizations and individuals can come up with more effective, desirable, and innovative solutions that are not only new but also useful and meaningful to the end users.		
	c)	**What role does risk-taking play in innovation?**	**[L1, CO3]**	**[2M]**
		• Risk-taking is an important part of innovation because trying new ideas always involves uncertainty. Innovative businesses must take risks to explore creative solutions, launch new products, or improve processes. • It is difficult to discover new opportunities or grow in a competitive market. For example, companies like Tesla and Apple took bold risks that led to groundbreaking innovations.		

	d)	**Why is customer-centric thinking important in innovation?**	**[L1, CO4]**	**[2M]**
		• Customer-centric thinking is important in innovation because it focuses on solving real customer problems and meeting their needs. When businesses understand what customers want, they can create better products and services that add value. This leads to higher customer satisfaction, loyalty, and success in the market. • For example, Netflix shifted to streaming by focusing on changing customer preferences.		
	e)	**Compare creativity and innovation**	**[L2, CO4]**	**[2M]**
		Key Differences Between Creativity and Innovation The following are the major differences between Creativity and Innovation: 1. The quality of thinking new ideas and putting them into reality is creativity. The act of executing the creative ideas into practice is innovation. 2. Creativity is an imaginative process as opposed to innovation is a productive process. 3. Creativity can never be measured, but Innovation can be measured. 4. Creativity is related to the generation of ideas which are new and unique. Conversely, Innovation is related to introduce something better into the market.		
2	**a)**	**Explain the concept of the art of innovation.**	**[L2, CO3]**	**[3 M]**
		• Innovation is the practical implementation of ideas that result in the introduction of new goods or services or improvement in offering goods or services. • The "art of innovation" refers to the creative process and strategic approach through which individuals or organizations develop new ideas, products, services, or solutions that drive progress and bring about meaningful change. • It combines both creative thinking and practical execution to generate value in ways that weren't previously imagined or possible. Innovation is not just about coming up with new ideas but also about implementing those ideas in real-world applications to solve problems, meet needs, or create new opportunities.		
2	**b)**	**Demonstrate the key principles of art of innovation.**	**[L2, CO3]**	**[7 M]**
		Key Principles of the Art of Innovation: **1. Be action oriented (Creativity + Execution):** • Creativity is the core of innovation, but ideas alone are not enough. Action-oriented innovators always must be active and turn their thoughts into action by searching for new ideas, opportunities, or source of innovations. • This principle emphasizes taking initiative and turning imaginative ideas into real-world outcomes, instead of waiting for perfect conditions.		

2. Risk-Taking and Experimentation:

- Innovation means exploring new ideas, which often comes with uncertainty and risk.
- Every new idea might not succeed, but through trial, error, and continuous improvement, innovators gather feedback about failures through the iterative process of experimentation—such as prototyping, testing, and evaluation.
- This principle emphasizes the importance of experimentation: testing, learning, and iterating. Failures are seen not as setbacks but as opportunities to learn and improve.

3. Problem-Solving and Value Creation:

- Innovation should focus on solving real-world problems and addressing unmet needs. It's not just about creating something new for the sake of it, but about making a meaningful impact on society, businesses, or individuals.
- The art of innovation lies in identifying the right problems to solve and delivering solutions that create value.

4. Collaboration and Cross-Disciplinary Thinking:

- Many of the world's most successful innovations comes from collaborative efforts across different fields.
- When people from diverse backgrounds (engineering, design, business, etc.) work together, they bring unique viewpoints and complementary skills, resulting in more holistic and effective solutions. Collaboration sparks creativity and accelerates innovation.

4. Start small:

- Innovators should not attempt a project or development on a magnificent scale. They should begin small and then build and develop, allowing for planned growth and proper expansion in the right manner and at the right time

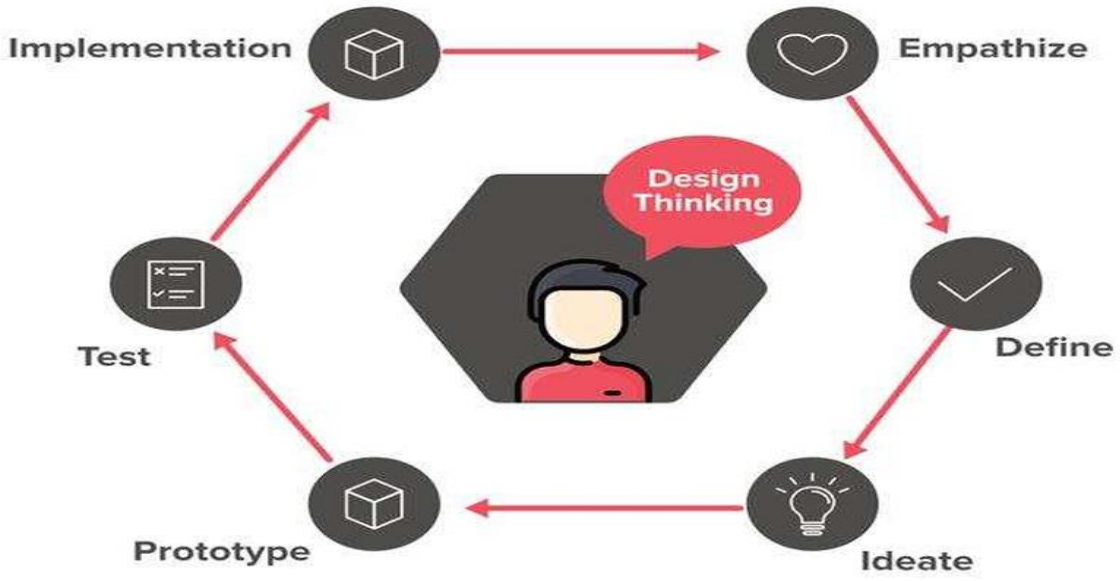
5. Adaptability and Flexibility:

- The innovation process is rarely linear. Ideas evolve, challenges arise, and conditions change. Innovators should maintain a flexible mindset in their perspectives and strategies, willing to adapt their ideas or methods based on feedback or emerging insights. This adaptability ensures that innovations remain relevant and practical over time.

6. Customer-Centricity:

- Successful innovations arise from a deep understanding of the needs, desires, and pain points of the end users. When innovators place the customer or intended user at the center of the innovation process, it ensures that the outcomes are relevant, desirable, and lead to better-

		designed solutions based on real experiences. • As highlighted in user-centered design, empathy plays a pivotal role in uncovering latent user needs and in ensuring that innovations deliver meaningful value. **7. Persistence and Long-Term Vision:** • Innovation is often a journey that requires persistence, patience, and a long-term vision. It takes time to foster ideas, build prototypes, and scale them to completion. • Innovators must be able to stay committed to their vision, even when the process is challenging or when initial efforts fail. **8. Continuous Learning:** • The art of innovation requires a mindset of continuous learning. Innovators stay curious, constantly seeking new knowledge, trends, technologies, and techniques that can help improve their work. They are open-minded to new ideas and adapt to changes in the market or technology landscape.		
3		**Evaluate the effectiveness of design thinking in driving innovation across its different stages.**	**[L5, CO3]**	**[10M]**
		• Design thinking is a human-centered, problem-solving approach that plays a major role in driving innovation. It helps innovators focus on the real needs of users, encouraging empathy, creativity, and experimentation. By involving users early in the process and testing solutions frequently, design thinking leads to more practical, user-friendly, and effective innovations. • It helps innovators create better products, services, or solutions by deeply understanding the needs of users and focusing on solving real problems in a practical and human-centered way. • By using design thinking, organizations and individuals can come up with more effective, desirable, and innovative solutions that are not only new but also useful and meaningful to the end users. **Design thinking promotes:** • Empathy for end users, • Collaboration across disciplines, • And rapid prototyping and testing of ideas. This helps create solutions that are not only new but also relevant, useful, and impactful. **Main Stages of Design Thinking:**		



1. **Empathize:**

- This is the first and most important step. It involves understanding the user's feelings, experiences, needs, and challenges. Innovators observe, interview, and engage with people to get a clear idea of what problems they face.
- The goal is to **immerse** in the problem space, observe users, and gather deep insights

Activities:

- **User Research**: Interviews, field studies, ethnographic research.
- **Empathy Building**: Understanding user pain points and behaviours.
- **Benchmarking**: Studying competitors and industry trends.
- **Example:** If designing a **smart water bottle**, IDEO would study how people stay hydrated, challenges in remembering to drink water, and factors influencing consumption habits

2. **Define:**

- In this stage, the information gathered from the empathy stage is used to clearly define the real problem. A clear problem statement helps to focus on solving the right issue instead of wasting time on the wrong one.

3. **Ideate stage (Generating and refining ideas):**

- Now that the problem is clear, the next step is to generate as many ideas as possible. Brainstorming and thinking creatively are encouraged. There are no wrong ideas—this stage is all about exploring different possibilities.
- The goal is to brainstorm **creative solutions** based on insights gathered.

Activities:

- **Brainstorming:** Generating a wide range of ideas without judgment.
- **Concept Sketching**: Visualizing possible solutions.
- **Prototyping**: Rapid low-fidelity models to test feasibility.
- **Feedback & Iteration**: Refining ideas based on user input.
- **Example:** For a smart water bottle, ideas might include a **hydration-tracking app, LED reminders, temperature control**, or a bottle that syncs with fitness trackers.

4. Prototype:

A prototype is a simple, early version of a solution or product. It could be a sketch, model, or basic version that allows testing the idea quickly and cheaply. The goal is to make ideas real so they can be shared and improved.

5. Test:

The prototype is tested with real users to get feedback. Based on this feedback, changes are made to improve the solution. This stage may lead back to earlier stages (like redefining the problem or creating a new prototype) until the best solution is found.

6. Implementation stage (Bringing ideas to life)

- The goal is to **develop and launch** the best ideas into real-world products or services.

Activities:

- **Refining Prototypes**: Moving from low-fidelity models to functional prototypes.
- **Testing & Validation**: Gathering real-user feedback for improvements.
- **Manufacturing & Scaling**: Ensuring the product is feasible for production.
- **Market Launch & Growth Strategy**: Branding, marketing, and distribution planning.

Example: A smart water bottle would go through **final testing**, manufacturing partnerships, and marketing efforts before being sold online or in stores.

4		**How do organizations build an innovation-friendly culture? Provide examples.**	**[L3, CO3]**	**[10M]**

- Creating an innovation-friendly culture means building an environment where employees are encouraged to think creatively, try new ideas, take risks, and learn from failure. For an organization to innovate successfully, it needs a supportive culture that promotes curiosity, experimentation, and collaboration.

1. Encouraging Creativity and New Ideas

- Organizations promote innovation by giving employees the freedom to think differently and express their ideas.
- Brainstorming sessions, open discussions, and idea-sharing platforms are used to gather

suggestions from employees at all levels.

- **Example:** Google allows its employees to spend 20% of their time on side projects, which has led to products like Gmail and Google Maps.

2. Supportive Leadership

- Leaders play a key role in shaping an innovation culture by inspiring, guiding, and supporting their teams.
- Good leaders encourage experimentation and do not punish failures—instead, they treat them as learning opportunities.
- **Example:** At **3M (Minnesota Mining and Manufacturing Company)**, leadership supports a "15% rule" where employees can spend time on personal projects. Post-it Notes were created through this approach.

3. Collaboration and Teamwork

- Innovation thrives when people from different backgrounds and departments work together.
- Cross-functional teams help bring in different perspectives and skills, leading to better ideas.
- **Example:** At **Apple**, designers, engineers, and marketers collaborate closely during product development to ensure both innovation and customer satisfaction.

4. Learning Environment and Training

- Organizations that invest in employee learning create a growth mindset. Training programs, workshops, and access to learning tools help employees stay updated with new skills and trends.
- A culture of **continuous learning** helps employees feel more confident to try new approaches.
- **Example:** Infosys provides digital learning platforms to help employees upgrade their skills and think innovatively.

5. Recognizing and Rewarding Innovation

- When employees are rewarded for their ideas and efforts, they feel valued and motivated.
- Rewards can be financial or non-financial—such as recognition, promotions, or opportunities to lead projects.
- **Example:** Tata Group has an annual **"Innovista"** event that celebrates and rewards innovative ideas from employees across all its companies.

6. Safe Space to Fail and Try Again

- An innovation culture accepts that failure is a natural part of the process.
- Instead of blaming employees for mistakes, organizations should analyze what went wrong and how to improve.

		• This creates a **safe environment** where people are not afraid to take risks. • **Example:** Amazon encourages experiments—even if some fail. Projects like AWS (Amazon Web Services) came from a culture that supported bold new ideas.		
5		**Assess the impact of digital transformation on innovation strategies in leading organizations.**	**[L5, CO3]**	**[10M]**
		• In today's world, **technology and digital transformation** are playing a major role in driving innovation across all fields. From smartphones to artificial intelligence, modern technologies have changed the way we work, learn, communicate, and solve problems. • Digital tools and technologies have made it easier and faster to create new products, improve services, and find creative solutions. They help individuals, businesses, and governments to innovate in smarter, more efficient, and more customer-friendly ways. **1. Faster Problem Solving and Decision Making** • Technology allows faster access to information, data analysis, and communication. • This helps innovators make better decisions quickly and solve problems in real time. • For example, cloud computing and AI tools help businesses analyze customer needs and improve services quickly. **2. Automation and Efficiency** • Digital technologies such as **robotics, AI, and machine learning** automate routine tasks, which saves time and resources. • This allows people to focus on more creative and strategic parts of innovation. • Example: Automated manufacturing in industries improves production speed and quality. **3. Access to Global Collaboration** • The internet and digital platforms allow people to work together from anywhere in the world. • Teams from different countries can share ideas, collaborate, and innovate together without meeting in person. • Tools like Zoom, Google Meet, and project management software make this possible. **4. Personalization and Better User Experience** • Technologies like **Big Data and Artificial Intelligence** help businesses understand user behaviour and preferences. • This allows them to create personalized products and services that meet specific customer needs. • Example: Netflix and Amazon use data to recommend movies and products based on user interests. **5. Digital Tools for Innovation**		

		• Today, anyone with access to a smartphone or computer can use tools like design software, coding platforms, or 3D printing to create and test new ideas. • These tools make innovation more **affordable**, **accessible**, and **scalable**. **6. Transformation in Education, Healthcare, and Business** • In education: Online learning platforms allow students to access courses from top universities. • In healthcare: Telemedicine and AI-powered diagnosis improve patient care. • In business: E-commerce and digital marketing open up new markets and customers.		
6	**a)**	**Define creativity and innovation with suitable examples.**	**[L2, CO3]**	**[5M]**
		Definition of Creativity: • Creativity is the characteristic of a person to generate new ideas, alternatives, solutions, and possibilities in a unique and different way. • Creativity is the ability to conceive something unpredictable, original and unique. It must be expressive, exciting and imaginative. It is the mirror of how beautifully a person can think in any given circumstance. **Example:** • A writer stands up with the very unique storyline or script and engaging characters for a novel that attracts and captivates the readers with its uniqueness, originality, and imaginative storytelling. In addition to the original story and engaging characters, the writer also creates narrative techniques, like non-linear storytelling and various perspectives. So, this is the creativity, which is expressed by the writer in terms of the novel **Definition of Innovation:** • Innovation is an act of application of **new ideas to which creates some value for the business organization, government, and society as well. Better and smarter way of doing anything is innovation.** **Example:** • A business company innovates compact and fully portable solar consisting powered chargers for laptop devices, which provide a convenient eco-friendly solution for charging. • Based on the success of this charger, the company also advances and innovates the advanced energy storage features in the device. So, this is Innovation, which is defined in terms of practical implementation from creativity.		
6	**b)**	**Distinguish between creativity and innovation.**	**[L4, CO3]**	**[5M]**

Basis	Creativity	Innovation
Definition	The process to create new and valuable ideas for organizations and governments. The ability to generate new and original ideas.	The process of practically implementing creative ideas and actually delivering the intended values. The process of turning creative ideas into practical and useful solutions.
Focus	The main focus is applied to idea generation. Thinking outside the box.	The main focus is applied to idea implementation. Implementing and applying new ideas.
Output	Output is seen in terms of concepts, ideas, insights, etc.	Output is seen in terms of new products, services, business models, etc.
Scope	Individual thinking and ideation are the main scopes of creativity.	Organizational and systemic change is the main scope of innovation.
Execution	Mental and imaginative execution is seen in creativity.	Requires action, practical implementation, and execution.
Emphasis	Emphasis is on originality, uniqueness, and novelty.	Emphasis is on market viability and applicability.
Nature	Abstract, imaginative, and limitless.	Practical, structured, and goal-oriented.
Process	Imaginative	Productive
Related to	Thinking something new	Introducing something new
Money Consumption	No	Yes
Risk	No	Yes
Quantifiable	No	Yes
Outcome	Unique concepts, artistic works, or fresh perspectives	New products, services, processes, or business models

		Measurement	Hard to measure; depends on originality.	Can be measured by impact, efficiency, and market value.
		Example	An artist sketches a futuristic car design.	A company manufactures and sells the car using advanced materials and AI technology.

7	**a)**	**How do organizations transform creative ideas into innovative solutions?**	**[L2, CO3]**	**[5M]**

Creativity to Innovation: Transforming Ideas into Reality

- Creativity and innovation are closely linked, but they are **not the same**.
- Creativity is about **generating new ideas**, while innovation is about **implementing those ideas** to create value.
- Let's explore how creativity turns into innovation in organizations and everyday life!

1. Understanding Creativity vs. Innovation

- **Creativity** = Thinking of unique, original, and imaginative ideas.
- **Innovation** = Applying creative ideas in a way that brings **practical benefits**.

Example:

- **Creativity:** Coming up with the idea for a **smartphone with a foldable screen**.
- **Innovation:** Actually, **developing and launching** that foldable phone for consumers!

2. The Process of Turning Creativity into Innovation

Step 1: Idea Generation (Creativity)

- Brainstorming and **exploring possibilities**.
- Thinking of **unique solutions** to existing problems.
- Encouraging a culture of **curiosity and experimentation**.
- **Example:** A company notices that customers struggle with **tangled earphone wires** and comes up with the idea of **wireless earbuds**.

Step 2: Idea Evaluation & Feasibility Check

- Filtering out the **best ideas** based on feasibility and market demand.
- Conducting **research and testing** before moving forward.
- Ensuring **practical application** of the creative idea.
- **Example:** Engineers test whether **wireless earbuds** can be built with long battery life and a good connection.

Step 3: Prototyping & Experimentation

- Creating a **prototype** (initial model) to test the idea.
- Refining the product based on **feedback**.
- **Iterating** (making improvements) before full-scale production.
- **Example:** Apple prototypes **AirPods**, improving battery, sound quality, and design before mass production.

Step 4: Implementation & Execution

- Launching the **final version** of the product or service.
- **Marketing and distributing** the innovation to customers.
- Monitoring feedback to **improve** the innovation further.
- **Example:** Apple **officially releases AirPods**, revolutionizing the wireless audio industry.

Step 5: Continuous Improvement & Scaling

- **Updating and enhancing** the product/service over time.
- Expanding innovation to **new markets and industries**
- **Example:** Apple later releases **AirPods Pro** with noise cancellation and better features.

7	b)	**Choose some real world examples of creativity leading to innovation.**	**[L3, CO3]**	**[5M]**

Real-Life Examples of Creativity Leading to Innovation

Netflix

- Creativity: A new way to rent movies online.
- Innovation: Transitioned from **DVD rentals to a streaming service**, changing how people watch content.

Tesla

- Creativity: The idea of **electric, self-driving cars**.
- Innovation: Developed and launched **high-performance electric cars** with **Autopilot features**.

Amazon

- Creativity: What if **shopping was entirely online**?
- Innovation: Created the world's **largest e-commerce platform** with advanced logistics and AI-driven recommendations.

For creativity to turn into innovation, the following conditions are important:

- **Encourage open-minded thinking** in teams.
- **Provide a safe space for experimentation & failure**.
- **Invest in research & development** (R&D).

		• **Stay customer-focused** – solve real-world problems. • **Embrace technology and new trends** to stay ahead. • Creativity **sparks ideas**, but innovation **makes them real**! Companies and individuals who master the journey from creativity to innovation can **drive change, stay competitive, and shape the future**.		
8		**Explain the importance of creativity and innovation in achieving organizational success, with examples.**	**[L2, CO4]**	**[10M]**
		• In today's fast-changing world, creativity and innovation are essential for organizations to stay competitive, grow, and solve problems effectively. Let's explore their roles in organizations: **1. Driving Business Growth** • Creativity helps generate new ideas for products, services, or processes. • Innovation turns those ideas into real solutions that add value. • Helps organizations differentiate themselves from competitors. **Example:** Apple revolutionized the Smartphone industry by innovating user-friendly designs and seamless technology integration. **2. Improving Problem-Solving & Efficiency** • Creativity allows companies to think outside the box and solve problems in unique ways. • Innovation leads to better processes, reducing costs and increasing efficiency. Example: Toyota's Lean Manufacturing System introduced innovative ways to reduce waste and improve productivity. **3. Enhancing Employee Engagement & Workplace Culture** • A creative workplace encourages employees to share new ideas. • Innovation-driven organizations create a culture of learning & experimentation. • Employees feel more motivated, valued, and engaged. **Example**: Google's 20% Rule allows employees to spend 20% of their time on side projects, leading to innovations like Gmail! **4. Boosting Customer Satisfaction & Market Demand** • Creativity helps organizations anticipate customer needs before they even arise. • Innovation ensures companies deliver better products and services to their customers. **Example:** Netflix innovated the entertainment industry by shifting from DVD rentals to streaming, based on changing customer preferences. **5.Encouraging Adaptability in a Changing World** • Creative organizations are more flexible and adaptable to new market trends.		

		• Innovation helps companies stay ahead of competitors and navigate crises. **Example:** During the COVID-19 pandemic, businesses quickly shifted to digital solutions, including remote work and online sales. Creativity fuels innovation, and innovation drives success. Organizations that encourage both can: o Stay competitive o Improve efficiency o Keep customers happy o Empower employees o Adapt to future changes		
9		**Demonstrate the role of collaboration in the creativity and innovation process. Provide examples.**	**[L2, CO4]**	**[10M]**
		Role of Collaboration in the Creativity and Innovation Process • Collaboration plays a key role in the creativity and innovation process because it brings together diverse ideas, skills, and perspectives that help in developing better and more innovative solutions. When individuals from different backgrounds work together, they can think more creatively, solve problems faster, and turn ideas into successful outcomes. **1. Combining Different Perspectives** • People from various departments or fields bring unique viewpoints. • This helps in generating fresh and creative ideas that one person alone might not think of. • **Example**: In a car company, engineers, designers, and marketers work together to create an electric car that is not only technically strong but also stylish and appealing to customers. **2. Faster Problem-Solving** • Teams can tackle problems more effectively by sharing knowledge and expertise. • Collaboration helps in identifying potential challenges and finding better solutions quickly. • **Example**: During the COVID-19 pandemic, healthcare professionals, scientists, and government agencies worked together to create vaccines in record time. **3. Encouraging Creative Thinking** • A collaborative environment encourages open discussion and brainstorming. • Team members build on each other's ideas to come up with creative solutions. • **Example**: At Pixar, employees from different departments regularly brainstorm together, which has led to the creation of many successful animated movies. **4. Turning Ideas into Action** • Collaboration helps move ideas from the creative stage to real implementation.		

		• Teams can divide tasks, share resources, and support each other throughout the process. • **Example**: In tech companies like Microsoft or Google, product development involves collaboration between developers, designers, and customer feedback teams to turn ideas into usable apps and software. **5. Building an Innovation Culture** • Collaboration builds trust and teamwork, creating a culture where innovation is supported and encouraged. • Employees feel motivated to contribute and experiment without fear of failure. **Example**: Google's "20% time" policy encourages employees to work on personal ideas and collaborate with others. This led to innovations like Gmail and Google Maps.		
10		**Assess the effectiveness of different metrics used to measure innovation success within organizations.**	**[L5, CO4]**	**[10M]**
		• Organizations measure the success of their innovation strategies by using a combination of financial, operational, and qualitative indicators. These measurements help determine whether the innovation efforts are achieving desired outcomes such as growth, competitiveness, and customer satisfaction. • The detailed explanation of the key ways organizations assessing the success of innovation**:** **1.Financial Performance Metrics:** **Revenue from New Products/Services:** • One of the most common ways to measure innovation success is to track how much income is generated from newly introduced products or services. • For example, a company may calculate the percentage of total revenue that comes from innovations launched in the last 3–5 years. A higher percentage shows successful innovation. **Return on Innovation Investment (ROII):** • This metric compares the profit gained from innovation initiatives to the amount invested. If a company spends $1 million on R&D and earns $3 million from the resulting products, the ROII is high, showing a successful strategy. **2. Process and Operational Metrics:** • **Time to Market:** This refers to how quickly a company can bring an innovative idea from concept to actual market launch. A shorter time indicates an efficient innovation process, which can give a competitive advantage. • **Number of Ideas Generated and Implemented:** Tracking how many new ideas are submitted and how many of them are successfully developed shows the level of employee engagement and		

		the effectiveness of the idea management process. • **Conversion Rate:** This shows the percentage of ideas that successfully move through the innovation pipeline (from idea to prototype to market). A high conversion rate often reflects a well-managed innovation process. **3. Qualitative and Strategic Metrics:** • **Customer Feedback and Satisfaction:** Customer opinions are very important in judging the success of innovation. If customers are happy with new products or services, this shows that the innovation is meeting market needs. • **Employee Engagement in Innovation:** Organizations may measure how involved and motivated employees are in contributing ideas. This is often done through internal surveys or by tracking participation in innovation programs. • **Alignment with Strategic Goals:** Successful innovation must support the organization's overall mission and long-term objectives. For example, if a company's goal is sustainability, innovations that reduce carbon emissions are seen as successful. • **Brand Image and Market Position:** Innovation can also be measured through its impact on the brand. A company that is seen as modern and forward-thinking due to its innovation efforts may experience an improved reputation and increased market share.		
11		**Evaluate the effectiveness of current practices used by companies to measure creativity and innovation outcomes.**	**[L5, CO4]**	**[10M]**
		• Businesses can measure the **impact and value of creativity and innovation** by evaluating how these elements contribute to **growth, performance, competitiveness, and customer satisfaction**. • Creativity and innovation lead to new ideas, improved processes, and unique products or services, but their success must be measured using a variety of indicators. **1. Key Performance Indicators (KPIs)** • KPIs are measurable values that indicate how effectively a project or initiative is achieving its key objectives. When applied to creativity, KPIs can help quantify the impact of creative efforts in various ways. Some KPIs for measuring creativity might include: • **Sales and Revenue Growth**: In product development or marketing, creativity often leads to increased sales or revenue. Tracking sales figures before and after the introduction of a creative product or campaign can provide a direct measure of creative impact. • **Customer Engagement and Satisfaction**: Metrics like customer feedback, online reviews, Net Promoter Score (NPS), social media engagement (likes, shares, comments), and customer		

retention can measure how well creative efforts resonate with the audience.

- **Cost Savings**: Creativity often leads to efficiencies in process improvement, reducing waste or optimizing resources. Tracking operational costs before and after a creative initiative can demonstrate its value.

2. Creative Output Metrics and implementation

- These metrics track the volume, diversity, and quality of creative ideas produced within an organization or team. Examples include:
- **Number of Ideas Generated**: This could include brainstorming sessions, submissions to innovation programs, or new product concepts developed within a set time period.
- **Patents or Intellectual Property (IP) Created**: For industries focused on research and development, measuring the number of patents, trademarks, or other forms of IP generated can reflect the impact of creativity on innovation.
- **Awards and Recognition**: While subjective, awards or industry recognition (such as design awards or innovation prizes) are often used as a marker of high-quality creativity and can be a useful indicator of success.

3**. Customer-Centric Metrics**

- Creativity is often most valuable when it resonates with customers, either by solving their problems or providing an enjoyable experience. Key metrics here include:
- **Customer Satisfaction (CSAT)**: After the launch of a creative product or marketing campaign, measuring customer satisfaction helps assess the effectiveness of the creative effort in meeting customer expectations.
- **Customer Lifetime Value (CLTV)**: Creativity that fosters customer loyalty and repeat business can be measured through CLTV, which estimates the total revenue a customer will generate throughout their relationship with a company.

4. Employee and Organizational Metrics

- Creativity is also a key driver of organizational culture and employee satisfaction. Measuring creativity's impact on these areas includes:
- **Employee Engagement**: Creative environments tend to boost employee engagement, which can be measured through surveys or tools like Gallup's Q12 to understand how invested employees are in their work.
- **Innovation Culture**: Measuring the prevalence of innovative thinking and creativity within the organization's culture can help gauge how deeply creativity is embedded in the organizational

DNA.

- **Collaboration and Knowledge Sharing**: In creative teams, collaboration is key. Metrics around cross-departmental collaboration, knowledge-sharing platforms, and team dynamics can give insights into the impact of creativity on teamwork.

5. Impact on Business Outcomes

- Ultimately, the value of creativity must be assessed in terms of its broader impact on business goals and organizational performance. Common business outcomes that can be linked to creative initiatives include:
- **Revenue Growth and Profitability**: Did the creative efforts contribute to revenue generation or cost reductions, and what impact did they have on profitability?
- **Brand Strength and Market Position**: Creativity in branding and customer experience can be tracked through changes in brand perception, customer loyalty, and competitive positioning.
- **Business Sustainability and Long-Term Viability**: Creative thinking often leads to the development of sustainable products, processes, or business models. Tracking metrics like long-term market share or sustainability indices can help assess how creativity drives lasting value.

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY::PUTTUR
(AUTONOMOUS)
Siddharth Nagar, Narayanavanam Road–517583

Subject with Code: DESIGN THINKING & INNOVATION (23HS0815) **Course&Branch:** Common to ALL Engineering branches

Year& Sem: II B.Tech & II Sem **Regulation:** R23

UNIT IV

Product Design

1	a)	**What is problem formation in product design?**	**[L1,CO5]**	**[2M]**
		• Problem formation is a crucial first step in product design, especially within the Design Thinking process. It helps in identifying the real problem rather than just addressing the symptoms. • Design Thinking follows a human-centered approach, meaning the problem is framed from the user's perspective to create meaningful solutions.		
	b)	**Define product design and its key components.**	**[L1,CO5]**	**[2M]**
		• **Product design** is the process of imagining, creating, and improving products that solve user problems or meet market needs, while balancing user experience with business goals to ensure long-term success and sustainability. • Key Components: 1. User Experience (UX) 2. Business Strategy 3. Research & Development (R&D) 4. UI Design (User Interface Design) 5. Brand Experience 6. Visual Design		
	c)	**What are the different types of product strategies?**	**[L1,CO5]**	**[2M]**
		Product Strategies in Design Thinking • User-Centered Strategy • Minimum Viable Product (MVP) Strategy • Iterative Prototyping Strategy • Value Innovation Strategy • Sustainable & Ethical Design Strategy • Agile Development Strategy • Business Model Innovation Strategy • Emotional & Brand Connection Strategy		
	d)	**How does product value impact a company's success?**	**[L1,CO5]**	**[2M]**
		Product value significantly impacts a company's success. Here are some key ways: • Customer Satisfaction		

		• Revenue Growth • Competitive Advantage • Customer Loyalty • Brand Reputation • Market Share • Innovation		
	e)	**What factors influence product planning?**	**[L1,CO5]**	**[2M]**
		Product planning is influenced by numerous factors, including • customer needs, • market demand, • competition, • technological advancements, • cost, and regulatory environments, • All of which impact product design, development, and lifecycle.		
2		**Describe the steps involved in problem formation and its importance in product design**	**[L2,CO5]**	**[10M]**
		• Problem formation is a **crucial first step** in the **Design thinking process**. It helps in identifying the **real problem** rather than just addressing the symptoms. • Design thinking follows a human-centered approach, meaning the problem is framed **from the user's perspective** to create meaningful solutions. **Key Steps in Problem Formation** 1. **Empathizing with Users** • Understand user needs, pain points, and behaviors. • Use tools like interviews, surveys, and observations. • Example: If designing a food delivery app, observe how users currently order food. 2. **Defining the Problem Statement** • Convert user insights into a clear, actionable problem statement. • Focus on who the users are, what they need, and why they need it. • Example: Instead of "Improve the app UI," reframe it as "Users need a faster way to reorder their favorite meals." 3. **Identifying Root Causes** • Use frameworks like 5 Whys Analysis or Fishbone Diagram to uncover deep-seated issues. • Example: If a website has low traffic, ask "Why?" repeatedly until the real cause (slow loading speed, poor SEO, etc.) is found. 4. **Validating the Problem** • Test assumptions with real users.		

- Example: If users say they struggle with **finding relevant products**, conduct usability tests to confirm.

5.**Breaking Down the Problem**

- Divide complex problems into **smaller, manageable challenges**.
- Example: A company struggling with **customer retention** can break it down into:
  - Poor customer service
  - Limited loyalty programs
  - High product return rates

Importance of Problem Formation in Design Thinking

- Helps in **solving the right problem**
- Improves **innovation and creativity**
- Ensures **user-centered solutions**
- Saves **time and resources**

3	**a)**	**State product design and List out the different types of product strategies.**	**[L1, CO5]**	**[3M]**

Product design is the process of imagining, creating, and improving products that solve user problems or meet market needs, while balancing user experience with business goals to ensure long-term success and sustainability.

Product Strategies in Design Thinking

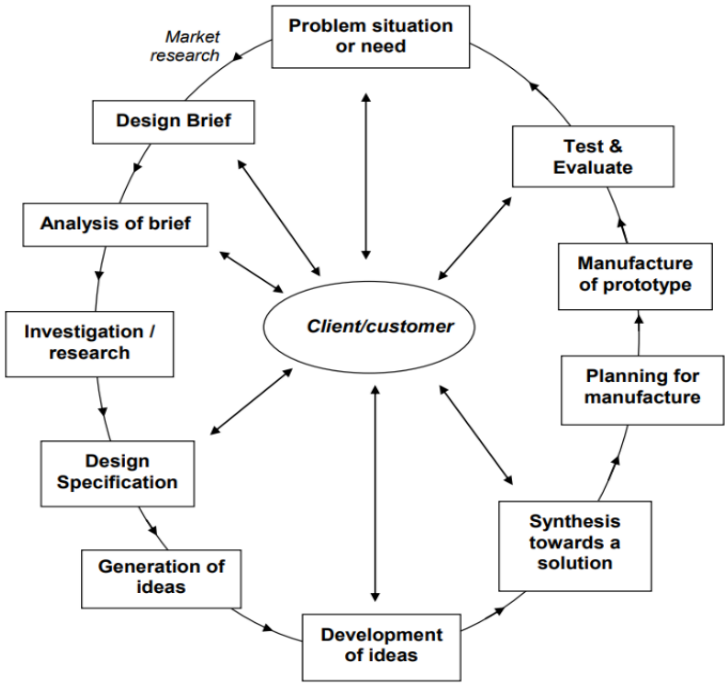
- User-Centered Strategy
- Minimum Viable Product (MVP) Strategy
- Iterative Prototyping Strategy
- Value Innovation Strategy
- Sustainable & Ethical Design Strategy
- Agile Development Strategy
- Business Model Innovation Strategy
- Emotional & Brand Connection Strategy

3	**b)**	**Write the key stages in the product design process.**	**[L3, CO5]**	**[7M]**

Key Stages of the Design Process:

1. **Problem Situation or Need** – Identifying the issue that requires a design solution.
2. **Design Brief** – Defining the problem scope and constraints based on market research.
3. **Analysis of Brief** – Understanding requirements and limitations in-depth.
4. **Investigation / Research** – Conducting user research, market analysis, and feasibility studies.
5. **Design Specification** – Establishing technical and functional requirements.
6. **Generation of Ideas** – Brainstorming potential solutions.

7. **Development of Ideas** – Refining and improving ideas into workable concepts.
8. **Synthesis Towards a Solution** – Converging on a viable design based on feasibility and usability.
9. **Planning for Manufacture** – Preparing for production, considering materials, costs, and scalability.
10. **Manufacture of Prototype** – Building a prototype for testing.
11. **Test & Evaluate** – Assessing the prototype's performance and making necessary refinements.



4		**Compare and contrast different product strategies used by companies.**	**[L4,CO5]**	**[10M]**

1. User-Centered Strategy

- Focuses on understanding and solving real user problems.
- Involves user research, personas, and user experience (UX) design.
- Example: Apple iPhone – Designed for simplicity, accessibility, and user-friendliness.

2. Minimum Viable Product (MVP) Strategy

- Develops a basic version of a product with essential features to test in the market.
- Helps in getting early user feedback before full-scale production.
- Example: Instagram started as a simple photo-sharing app before evolving into a full social mediaplatform.

3. Iterative Prototyping Strategy

- Uses rapid prototyping to create and test multiple versions before finalizing the product.

		• Reduces design flaws and improves usability. • Example: Tesla continuously updates car software based on real-time user feedback. **4. Value Innovation Strategy** • Focuses on creating unique value for users while keeping costs low. • Aims to differentiate the product in the market. • Example: Airbnb – Provided affordable travel experiences by leveraging existing properties. **5. Sustainable & Ethical Design Strategy** • Emphasizes eco-friendly materials, recyclability, and energy efficiency. • Aims to reduce environmental impact and promote sustainability. • Example: Patagonia – Uses recycled materials to create sustainable outdoor gear. **6. Agile Development Strategy** • Involves continuous improvement and flexibility during the product development phase. • Adapts to changing market trends and consumer demands. • Example: Google products – Regular updates based on user feedback (e.g., Google Maps, Gmail). **7. Business Model Innovation Strategy** • Focuses on how the product creates revenue and delivers value. • May include subscription models, Premium services, or digital transformation. • Example: Netflix – Shifted from DVD rentals to a streaming subscription model. **8. Emotional & Brand Connection Strategy** • Aims to build emotional attachment between users and the product. • Uses storytelling, branding, and user experience to enhance loyalty. Example: Nike's "Just Do It" campaign – Creates an emotional connection with customers.		
5		**Analyze the role of perceived product value in shaping customer perception and market success.**	**[L4,CO5]**	**[10M]**
		Product Value refers to the perceived benefits and importance a product provides to users. • It includes functionality, emotional appeal, innovation, and business impact. • In Design Thinking, product value is maximized by understanding user needs and delivering meaningful, user-centered solution • Product value plays a pivotal role in shaping customer perception and determining market success. • It encompasses how customers evaluate a product's worth based on their needs, expectations, and experiences.Understanding and effectively managing perceived value can lead to increased customer satisfaction, loyalty, and competitive advantage.		

Impact on Market Success

- **Pricing Strategy**: Products with high perceived value can justify premium pricing, leading to higher profit margins.Conversely, products with lower perceived value may require competitive pricing to attract customers.
- **Competitive Advantage**: A unique value proposition that clearly communicates the benefits and differentiators of a product can set it apart from competitors, driving market share.
- **Customer Loyalty**: When customers perceive high value, they are more likely to become repeat buyers and brand advocates, contributing to long-term business success.

Strategies to Enhance Perceived Value

1. **Product Quality and Innovation**: Continuously improve product quality and introduce innovative features that meet or exceed customer expectations.
2. **Effective Branding**: Develop a strong brand identity that communicates reliability, quality, and trustworthiness.
3. **Customer Engagement**: Engage with customers through personalized experiences, responsive customer service, and active social media presence.
4. **Value-Based Pricing**: Implement pricing strategies that reflect the perceived value of the product, ensuring alignment with customer expectations.

6		**Discuss the significance of product planning in ensuring business success.**	**[L2,CO5]**	**[10M]**

- Product planning in Design Thinking is a strategic process that focuses on understanding user needs and creating innovative, practical solutions. It aligns product development with business goals while solving real user problems.
- Selecting the right product for a market is vital and relies on research, technology, and market demand. Manufacturers can choose from four key strategies based on the relationship between new and existing products and markets:

1. **MARKET PENETRATION**
   - An attempt to increase the sales of a product through activities such as advertising, promotions and special offers. This would involve existing products in current markets. It could be regarded as _injecting new life into an old product.
2. **PRODUCT DEVELOPMENT**
   - Deciding to develop new or improved products for an existing or established market.
3. **MARKETING DEVELOPMENT**
   - A strategy for company growth by identifying and developing new markets and new market segments for current company products. This can be done by finding new users, new customers or foreign markets.
4. **DIVERSIFICATION**
   - This can be done by designing, developing and selling entirely new products for the manufacturer in new markets.

7	a)	**Define product specifications and describe their key components.**	**[L2,CO5]**	**[5M]**

Product specifications are detailed, written descriptions of a product's design, features, materials, dimensions, performance standards, and other technical or functional requirements. They serve as a blueprint that guides the design, development, manufacturing, and quality assurance processes.

Key Components of Product Specifications:

1. **Product Overview:**
   - A brief description of the product, its purpose, and its target market.
2. **Functional Requirements:**
   - What the product must do (e.g., features, performance criteria).
3. **Technical Specifications:**
   - Details like size, weight, materials, tolerances, and operating conditions.
4. **Design Requirements:**

		o Visual aspects such as shape, color, style, and ergonomic features. 5. **Compliance and Standards:** o Industry standards, legal regulations, and safety requirements the product must meet. 6. **User Requirements:** o Specific needs and expectations from the end-user perspective. 7. **Testing and Quality Criteria:** o How the product will be tested and what benchmarks it must meet before approval. 8. **Constraints and Limitations:** o Budget, timeline, environmental, or technical limitations to be considered.		
7	**b)**	**Explain the importance of product specifications in guiding the design and Development process.**	**[L2, CO5]**	**[5M]**
		Importance of Product Specification (Specs): • **Clarity and Consistency:** Provides a clear and consistent reference for all stakeholders, ensuring a shared understanding of the product's requirements. • **Alignment with Objectives:** Helps align the product development process with strategic business objectives and customer needs. • **Communication Tool:** Serves as a communication tool between different teams involved in the product development lifecycle, fostering collaboration and understanding. • **Basis for Testing:** Forms the basis for testing activities, allowing quality assurance teams to verify that the product meets specified criteria. • **Risk Mitigation:** Identifies potential risks early in the development process, enabling proactive mitigation strategies. 		

8	a)	**Describe innovation drive product design.**	**[L2, CO5]**	**[5M]**

Innovation Drives Product Design:

- Innovation is a critical force in product design, shaping the way new products are conceptualized, developed, and delivered.
- It enables the creation of unique, user-centered, and market-relevant products that meet emerging needs or solve existing problems more effectively.
- The key ways innovation drives product design include:

1. **User-Centric Solutions:**
   - Innovation encourages designers to focus on unmet user needs, leading to more intuitive, functional, and desirable products.
2. **Technology Integration:**
   - Advances in technology, such as AI, IoT, and sustainable materials, open new possibilities in design, functionality, and performance.
3. **Market Differentiation:**
   - Innovative design helps products stand out in competitive markets by offering distinctive features or superior usability.
4. **Sustainability and Efficiency:**
   - Innovation leads to environmentally friendly designs that reduce waste, improve energy efficiency, and support circular economies.
5. **Speed and Flexibility:**
   - Agile methodologies and digital tools like CAD and rapid prototyping support faster design iterations and adaptations to changing demands.

8	b)	**Identify the key challenges in implementing innovation.**	**[L3, CO5]**	**[5M]**

Key Challenges in Implementing Innovation:

Despite its benefits, implementing innovation in product design comes with several challenges:

1. **High Costs and Resource Constraints:**
   - Developing innovative products often requires significant investment in R&D, skilled personnel, and advanced tools.
2. **Resistance to Change:**
   - Organizations may resist new ideas due to fear of failure, lack of vision, or preference for traditional methods.
3. **Market Uncertainty:**

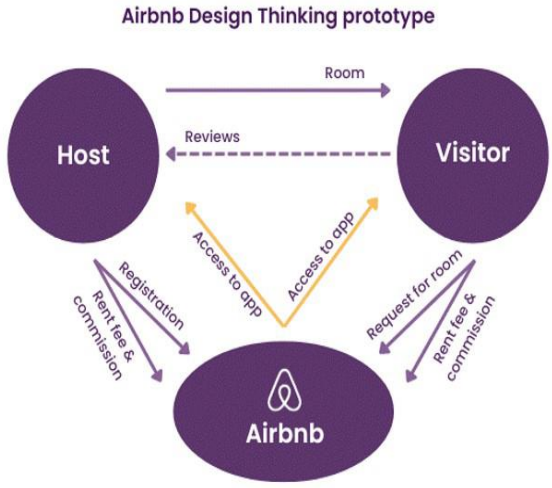
- Predicting user acceptance and market trends is difficult, making innovative products risky ventures.

4. **Technical Limitations:**
   - Innovative concepts may be ahead of current technological capabilities, leading to feasibility issues.
5. **Regulatory and Compliance Barriers:**
   - New designs may face hurdles in meeting industry standards, safety regulations, or legal approvals.

9		**Analyze a case study where innovation transformed a product or industry.**	**[L4,CO5]**	**[10M]**

Case Study: Airbnb

- Airbnb's is one of the popular Design Thinking Case Studies that you can aspire from. Airbnb disrupted the traditional hotel industry by applying Design Thinking principles to create a platform that connects travellers with unique accommodations worldwide.
- The founders of Airbnb, Brian Chesky, Joe Gebbia, and Nathan Blecharczyk, started by identifying a problem: the cost and lack of personalisation in traditional lodging.
- They conducted in-depth user research by staying in their own listings and collecting feedback from both hosts and guests. This empathetic approach allowed them to design a platform that not only met the needs of travellers but also empowered hosts to provide personalised experiences.



- Airbnb's intuitive website and mobile app interface, along with its robust review and rating system, instil trust and transparency, making users feel comfortable choosing from a vast array of properties.
- Furthermore, the "Experiences" feature reflects Airbnb's commitment to immersive travel,

		allowing users to book unique activities hosted by locals.		
10		**Describe how sustainability principles can be applied to the design of a common consumer product.**	**[L3,CO5]**	**[10M]**
		Role of Sustainability in Modern Product Design: • Sustainability has become a central aspect of modern product design, driven by increasing environmental awareness, regulatory requirements, and consumer demand for eco-friendly products. • It involves creating products that minimize negative environmental impact throughout their life cycle — from raw material extraction to production, use, and disposal. • The role of sustainability in modern product design includes: 1. **Material Selection:** • Designers prioritize the use of renewable, recyclable, biodegradable, or low-impact materials to reduce resource depletion and waste. 2. **Energy Efficiency:** • Sustainable design aims to reduce energy consumption during manufacturing and throughout the product's usage, often by integrating energy-saving technologies. 3. **Lifecycle Thinking:** • Designers adopt a cradle-to-cradle or circular economy approach, focusing on product longevity, repairability, reusability, and recyclability to extend the product's life and minimize landfill waste. 4. **Minimal Environmental Impact:** • Efforts are made to reduce emissions, water usage, and chemical pollutants during the product development process. 5. **Packaging and Distribution:** • Sustainable product design also includes eco-friendly packaging solutions and optimized logistics to lower the carbon footprint. 6. **Consumer Awareness and Responsibility:** • Modern designs often include features that educate and empower users to make environmentally responsible choices, such as modular components or indicators for end-of-life disposal.		
11		**Assess the effectiveness of various methods used to measure post-launch product success.**	**[L5,CO5]**	**[10M]**
		Measuring the Success of a Product After Its Launch: • Companies can evaluate the success of a product post-launch using a combination of		

quantitative and qualitative metrics.

- This measurement helps determine whether the product meets business goals, satisfies customers, and performs well in the market. Key methods include:

1. **Sales Performance:**
    - Tracking revenue, units sold, and market share provides direct insight into the product's commercial success.
    - Comparison with projected sales targets helps assess whether the product met expectations.
2. **Customer Feedback and Satisfaction:**
    - Surveys, reviews, and Net Promoter Score (NPS) reveal how well the product meets customer needs.
    - Positive feedback indicates acceptance, while complaints can highlight areas for improvement.
3. **Market Penetration:**
    - The extent to which the product captures its intended market segment is a key success indicator.
    - Adoption rate and brand recognition among the target audience are evaluated.
4. **Return on Investment (ROI):**
    - Comparing the revenue generated against the cost of development, marketing, and distribution determines profitability.
    - A high ROI indicates successful resource utilization.
5. **Customer Retention and Loyalty:**
    - Repeat purchases, subscription renewals, or upgrades reflect long-term customer value.
    - High retention rates indicate strong product-market fit.
6. **Product Usage Analytics:**
    - For digital or tech products, user engagement metrics (e.g., active users, session time, feature usage) are critical for understanding success.
    - High usage suggests the product is valuable and relevant.
7. **Market Response and Competitor Reaction:**
    - Media coverage, industry recognition, and competitor adjustments can signal the product’s impact.
    - A strong presence in discussions and trends reflects market influence.

		8. **Support and Return Metrics:** • Low product return rates and reduced customer support queries often indicate high product reliability and satisfaction.

Course Code: 23HS0815 **R23**

SIDDHARTH INSTITUTE OF ENGINEERING &TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
Siddharth Nagar, Narayanavanam Road–517583

Subject with Code: DESIGN THINKING & INNOVATION (23HS0815) **Course & Branch:** Common to ALL Engineering branches

Year& Sem: II B.Tech & II Sem **Regulation:** R23

UNIT–V
Design Thinking in Business Processes

1	**a)**	**Define design thinking, and how is it applied in business innovation?**	**[L1, CO6]**	**[2M]**
		• Design Thinking is a human-centered, iterative approach to problem-solving that emphasizes empathy, creativity, and experimentation. It involves understanding user needs, defining problems, ideating solutions, prototyping, and testing. • In business innovation, it is applied to develop customer-focused products and services, improve user experience, and solve complex challenges creatively. It helps companies reduce risk, speed up innovation, and stay competitive in dynamic markets.		
	b)	**How does design thinking help businesses solve complex problems?**	**[L1, CO6]**	**[2M]**
		• Design thinking helps businesses solve complex problems by focusing on user needs, encouraging creative idea generation, and using rapid prototyping to test solutions. • It breaks down big challenges into manageable steps, reduces risks, and promotes innovative, user-friendly outcomes through collaboration and continuous feedback.		
	c)	**What are the key principles of design thinking that redefine businesses?**	**[L1,CO6]**	**[2M]**
		• The key principles of design thinking are 1. Empathy (understanding user needs), 2. Collaboration (cross-functional teamwork), 3. ideation (generating creative solutions), 4. experimentation (rapid prototyping and testing), and 5. Iteration (continuous improvement). • These principles help businesses innovate, stay user-focused, and adapt quickly to change.		

	d)	**Why is empathy important in design thinking for business?**	**[L1,CO6]**	**[2M]**
		• Empathy is important in design thinking because it helps businesses deeply understand the real needs, emotions, and challenges of their customers. • By putting themselves in the users' shoes, businesses can create more relevant, user-friendly, and impactful solutions that truly solve real-world problems.		
	e)	**How can businesses use design thinking to create customer-centric products?**	**[L1,CO6]**	**[2M]**
		• Businesses can use design thinking by empathizing with customers to understand their needs, defining clear problems, brainstorming creative ideas, and developing prototypes. • By testing these with real users and refining based on feedback, they can design products that truly meet customer expectations and deliver better user experiences.		
2	**a)**	**Explain the concept of design thinking**	**[L2, CO6]**	**[5M]**
		Concept of Design Thinking: • Design Thinking is a human-centered, iterative approach to problem-solving that emphasizes empathy, creativity, and collaboration. Rather than focusing only on technology or business objectives, it starts with understanding the needs, emotions, and experiences of the end-user. • It is widely used not just in design but also in business strategy, product development, and service innovation to create meaningful, user-centric solutions to complex problems. **Core Stages of Design Thinking** • According to the Stanford d.school model, design thinking follows five key stages: • Empathize – Understand users' needs through observation and interaction. • Define – Frame the problem from the user's perspective. • Ideate – Generate a wide range of creative ideas and solutions. • Prototype – Create simple models to visualize solutions. • Test – Try out prototypes, gather feedback, and refine solutions. • These steps are not always linear and can be repeated for continuous improvement.		
2	**b)**	**Apply the design thinking process in driving business and strategic innovation.**	**[L3, CO6]**	**[5M]**
		Role of Design Thinking in Business Innovation • Design Thinking plays a critical role in driving business and strategic innovation in several ways:		

a. Customer-Centric Products and Services

- Design thinking places customers at the core of the innovation process. Businesses create offerings that are more aligned with real-world needs.
- **Example:** Apple designs intuitive products by focusing on user experience.

b. Encourages Innovation and Creativity

- It encourages teams to think outside the box and break away from traditional problem-solving.
- **Example:** Google's "Design Sprints" accelerate innovation in product teams.

c. Faster Time-to-Market

- Through rapid prototyping and testing, businesses can launch and refine products quickly.
- **Example:** Startups use MVP (Minimum Viable Product) models to test the market fast.

d. Reduces Risk and Cost

- Early testing and user feedback help identify flaws before full-scale development, saving time and resources.

e. Cross-functional Collaboration

- Design thinking encourages teamwork across departments, improving communication and innovation.
- **Example:** IBM uses design thinking across departments for software development and customer service.

Strategic Impact on Business

- Design Thinking supports long-term business goals by:
- Enhancing Brand Loyalty – Products designed with empathy create deeper connections with users.
- Adapting to Market Changes – Helps companies stay agile and responsive.
- Improving Internal Processes – Also used to redesign workflows and operations for efficiency.

Real-world Business Examples

- **Airbnb:** Used design thinking to revamp its listing experience by empathizing with users, leading to massive growth.
- **PepsiCo:** Transformed product design and branding through design-led strategy under CEO IndraNooyi.

3	**a)**	**What are the key principles of design thinking that redefine businesses and Provide examples?**	**[L2, CO6]**	**[6M]**

- Design thinking is a user-centric, solution-based approach to innovation that redefines how businesses create value.
- By focusing on empathy, ideation, experimentation, and collaboration, businesses can better understand customer needs and deliver impactful solutions.

Key Principles of Design Thinking

1.Empathy

- Understanding the real needs, emotions, and pain points of users.
- **Example:** Airbnb – Founders stayed in users' homes to experience problems first-hand. This empathetic approach led to better user experiences and massive business growth.

2. Define

- Clearly articulating the problem from the user's perspective.
- **Example:** Procter & Gamble (P&G) – Used user interviews to define issues with diaper comfort, leading to innovations in Pampers.

3. Ideation

- Brainstorming a wide range of creative ideas without limitations.
- **Example:** IDEO – Known for its collaborative ideation sessions to solve client problems creatively, from medical tools to retail experiences.

4. Prototyping

- Building quick, low-cost models or simulations of ideas to test functionality and user response.

- **Example:** Google – Uses rapid prototyping during its "Design Sprint" process to test product features and ideas before investing heavily.

5. Testing

- Trying out the prototypes with real users to gather feedback and improve the solution.
- **Example:** PepsiCo – Redesigned packaging after testing consumer responses, making it more user-friendly and sustainable.

6. Iteration

- Refining ideas continuously based on user feedback until the optimal solution is found.
- **Example:** Apple – Iterates constantly, from product design to user interfaces, by gathering customer feedback and improving with each release.

3	**b)**	**How companies that have successfully implemented design thinking principles.**	**[L3, CO6]**	**[4M]**

Design thinking principles redefine businesses

- **Shift from product-focus to user-focus** – Businesses start solving real problems, not just pushing products.
- **Accelerated innovation** – Faster development cycles with reduced risks and costs.
- **Encourages creative thinking** – Promotes new ideas that may not emerge from traditional business methods.
- **Improves customer satisfaction** – Leads to loyal users and better brand reputation.
- **Fosters teamwork and collaboration** – Cross-functional teams bring diverse perspectives to solve problems better.

4	**a)**	**Explain how design thinking helps businesses address growth challenges and improve predictability in their operations.**	**[L2, CO6]**	**[6M]**

- In today's fast-changing and competitive business environment, many companies face challenges like stalled growth, lack of innovation, and losing touch with customer needs.
- Traditional problem-solving approaches often fail to keep up. This is where design thinking plays a transformative role. It provides a human-centered, creative, and iterative process that helps businesses reimagine how they grow, innovate, and stay relevant.

Tackling Growth Challenges

Design thinking helps businesses find new opportunities by understanding what customers truly want—not just what companies think they want.

- Empathy enables companies to identify unmet needs and pain points, opening new paths for products or services.
- Ideation helps generate out-of-the-box ideas, creating disruptive solutions for stagnant markets.
- **Example:** Airbnb was struggling with growth until it used design thinking to deeply understand and redesign the user experience. That shift led to massive user engagement and business expansion.

Addressing Predictability and Stagnation

Markets today demand agility. When businesses follow rigid, linear strategies, they risk becoming predictable and outdated. Design thinking encourages:

- Rapid prototyping and testing, allowing for quick feedback and improvements.
- Experimentation, which lets companies take creative risks in a controlled way.
- **Example:** Google uses "design sprints" to speed up innovation and test ideas quickly, keeping their products fresh and forward-looking.

4	**b)**	**Discuss how design thinking supports businesses in maintaining relevance and competitive markets.**	**[L2, CO6]**	**[4M]**

Maintaining Relevance in Competitive Markets

Staying relevant means continuously evolving with changing customer needs and market trends. Design thinking:

- Keeps the customer at the center of decision-making.
- Supports continuous innovation, adapting solutions based on real-time feedback.
- Promotes cross-functional collaboration, aligning marketing, design, and development for better, user-driven outcomes.
- **Example:** Nike used design thinking to co-create products with athletes and customers, which helped it stay a leading, trend-setting brand.

Strategic Long-Term Benefits

- Boosts customer loyalty through better user experiences.
- Drives sustainable innovation by focusing on desirability, feasibility, and viability.
- Creates a culture of creativity where employees feel empowered to innovate.

5		**Compare and contrast the application of design thinking in large organizations versus startups. How does each benefit from this approach?**	**[L4, CO6]**	**[10M]**

- Design thinking is a user-centric, problem-solving approach that encourages empathy, creativity, and experimentation. Both large organizations and startups use design thinking, but the way they apply it — and the benefits they receive — can be quite different due to their size, structure, and business maturity.

Application in Startups

- Startups are usually small, fast-moving, and flexible. They often use design thinking naturally because they're building products from scratch and need to deeply understand user needs to survive.

Benefits for Startups:

- Rapid Innovation: Startups can quickly move through the design thinking cycle (empathize, define, ideate, prototype, test).
- Closer to Customers: Founders often talk directly to users, making empathy and user feedback easy to gather.
- Quick Pivoting: Startups benefit from the iterative nature of design thinking, helping them adapt quickly to market feedback.
- **Example:** Dropbox used simple prototyping and feedback loops in its early days to validate its idea before even building the product.

Application in Large Organizations

- Large enterprises are usually more structured and process-driven, which can make innovation harder. However, many use design thinking to break silos, modernize systems, and stay competitive.

Benefits for Large Organizations:

- Unlocks Creativity: Helps large teams think outside traditional business logic and spark innovation.
- Cross-Functional Collaboration: Encourages teams from different departments (marketing, engineering, design) to co-create solutions.
- Modernizes Legacy Processes: Design thinking helps reimagine old systems and improve customer experience.
- **Example**: IBM trained thousands of employees in design thinking to redesign services and boost customer satisfaction, leading to millions in revenue gains.

Aspect	Startups	Large Organizations
Speed of Execution	Fast, agile, experimental	Slower due to processes and hierarchy
Decision-Making	Founder-driven, flexible	Often requires multiple approvals
Risk Appetite	High – open to trying new ideas	Moderate – need to balance innovation with stability
Customer Interaction	Direct, continuous	Indirect – often through departments
Scalability	Still building systems	Focused on scaling across divisions

Shared Benefits

Despite their differences, both gain:

- Better understanding of user needs.
- Increased innovation capability.
- Stronger product-market fit.
- A more open and creative company culture.

6		**Analyze how design thinking helps businesses navigate extreme competition and adapt to market changes. Provide real-world examples.**	**[L4, CO6]**	**[10M]**

- In today's fast-paced world, businesses are under constant pressure to stand out in a highly competitive market. Consumer needs are changing quickly, and technology is evolving every day. In such conditions, traditional strategies often fall short.
- Design thinking offers a fresh, user-focused approach that helps businesses innovate, stay flexible, and respond to changes more effectively.

How Design Thinking Helps Businesses Compete and Adapt

a. Empathy-Driven Innovation

- Design thinking starts with empathy - understanding real user problems before jumping to solutions. This helps businesses build products that people truly want and need, instead of just what companies assume they need.
- **Example**: Spotify used user research and design thinking to personalize user experiences with daily mixes and discover playlists. This helped them compete strongly with Apple Music and other platforms.

b. Faster Adaptation through Prototyping & Testing

- Instead of spending months on a product that might fail, design thinking encourages quick prototyping and real-world testing. This allows teams to learn fast, make changes early, and reduce risk.
- **Example:** Ford adopted design thinking to reimagine the car ownership experience. They created small prototypes and tested ideas like subscription models and smart vehicles, adapting quickly to market trends.

c. Encourages Bold and Creative Thinking

- Design thinking helps teams break free from routine thinking. It creates a safe space to explore unconventional ideas, which is key to standing out in crowded markets.
- **Example:** PepsiCo used design thinking to innovate packaging and product design under its CEO of design, Mauro Porcini. It helped rejuvenate the brand and attract younger audiences, even in a saturated beverage market.

d. Keeps Businesses User-Centric

- Design thinking ensures that customers are always at the center. Businesses that apply this approach are more responsive to changing customer behaviors and expectations.
- **Example:** Netflix used design thinking to shift from DVD rentals to online streaming, and later into original content -all based on customer viewing habits and preferences.

e. Helps Build Agile, Collaborative Teams

		• In a highly competitive market, team collaboration across departments (marketing, tech, design, etc.) is crucial. Design thinking fosters open communication, fast feedback loops, and co-creation - making the company more adaptive.		
7		**Businesses often struggle with balancing standardization and innovation. Evaluate How does design thinking provide a solution to this challenge?**	**[L5, CO6]**	**[10M]**
		• For any business to succeed in the long run, it must balance two opposite needs — standardization (for efficiency, consistency, and scalability) and innovation (for creativity, adaptability, and future growth). • The challenge is that too much standardization can kill new ideas, while too much innovation can create chaos and inconsistency. This is where design thinking offers the perfect middle path — helping businesses remain structured while still thinking creatively. **How Design Thinking Solves the Balance Challenge** **a. Structured Creativity** • Design thinking follows a clear framework — Empathize, Define, Ideate, Prototype, and Test. This structure helps teams innovate in a disciplined way, making creativity manageable and repeatable. • **Example:** IBM uses its "Enterprise Design Thinking" framework across thousands of teams globally. It allows them to stay creative while maintaining quality and standard processes across departments. **b. Human-Centered Standardization** • Rather than blindly enforcing one-size-fits-all rules, design thinking encourages standardizing around user needs. So, even processes and solutions that are reused are still deeply relevant to the people they serve. • **Example**: Airbnb standardized its customer experience using design thinking. It created design systems that kept the brand consistent across global platforms, but every decision was based on deep user empathy and feedback. **c. Rapid Experimentation within Guidelines** • Design thinking allows for small, safe experiments (like quick prototypes or pilots) that don't disrupt the whole business. This enables innovation to happen within a controlled environment. • **Example:** GE Healthcare used design thinking to create a more comforting MRI experience for		

children, without redesigning the entire machine - proving that innovation doesn't need to break existing systems.

d. Cross-functional Collaboration

- Standardization often comes from top-down policies, while innovation thrives in diverse thinking. Design thinking brings both together by encouraging collaboration across roles and departments, breaking silos without losing structure.

e. Continuous Improvement Mindset

- Design thinking turns innovation into a routine, not a one-time event. This means businesses can continually improve and update standardized processes based on feedback and real-world usage, rather than waiting for a major overhaul.
- Design thinking helps businesses walk the fine line between keeping things stable and exploring new possibilities. It brings a structured approach to innovation, allowing companies to keep operations smooth while staying fresh and future-ready.
- Companies like IBM, Airbnb, and GE Healthcare show how design thinking can blend standardization with creativity, creating both efficiency and innovation hand-in-hand.

8		**Make use of design thinking to define and test business models? Explain the process with case studies.**	**[L3, CO6]**	**[10M]**

- Design thinking is a human-centered approach that helps businesses develop creative and practical solutions by deeply understanding user needs. When applied to business model innovation, it helps companies explore ideas, test assumptions, and build value-driven models in a risk-reduced way.
- This process allows businesses to move from vague ideas to validated models that solve real-world problems effectively.

Step-by-Step Process of Using Design Thinking to Define and Test Business Models

a. Empathize – Understand Users and Ecosystem

- The first step is to connect with customers, stakeholders, and partners to understand their pain points, desires, and behaviours.

Case Study: Grameen Bank

- Grameen Bank used empathy to understand why poor communities in Bangladesh were excluded from traditional banking. This led to the creation of a microcredit business model that trusted users and gave small loans without collateral.

b. Define – Identify Core Business Challenge

After gathering insights, businesses frame the real problem to solve. This helps focus the business model around genuine needs.

- **Case Study:** Nestlé Nespresso
- Nestlé discovered that coffee drinkers wanted a café-like experience at home. They defined the need for a premium and personalized home coffee model, which shaped the subscription-based Nespresso system.

c. Ideate – Generate Innovative Model Ideas

- Teams brainstorm ideas around value creation, delivery, and capture. This is where different pricing models, distribution methods, or revenue streams are explored.

Case Study: Spotify

- Spotify ideated around a freemium model, combining free ad-supported access with premium subscriptions. They considered user habits and artist partnerships before finalizing their successful model.

d. Prototype – Create Small-Scale Business Model Experiments

A prototype of the business model can be as simple as a landing page, a trial service, or a sample product - just enough to test the idea quickly and cheaply.

Case Study: Airbnb

- In its early days, Airbnb founders tested their idea by renting out their own apartment with air mattresses. This low-cost prototype helped validate user demand for a peer-to-peer home rental model.

e. Test – Get Feedback and Refine

- The prototype is tested with real users. Feedback is collected to validate assumptions, understand user response, and iterate the model before scaling.

Case Study: Dropbox

- Dropbox tested demand using just an animated explainer video. They got massive sign-ups, proving the model before writing even a single line of code.

9		**Outline the key steps involved in developing and testing a prototype to ensure it meets customer needs and expectations**	**[L2, CO6]**	**[10M]**

Developing and Testing

- The development of a prototype is a critical step in the product development process. Prototypes allow you to test your product concept and design to ensure that they meet your customer's needs and expectations.

1. **Define your product concept and design requirements.**
   - Before you begin developing your prototype, you need to have a clear idea of what your product is and what it should do. Write down your product concept and design requirements so that you can refer to them throughout the prototype development process.
2. **Identify the key components of your product.**
   - Once you have defined your product concept and design requirements, you need to identify the key components of your product. These components will be the focus of your prototype development**.**
3. **Develop a prototype plan.**
   - Now that you know what your product is and what it should do, you need to develop a plan for how you will create your prototype. This plan should include a timeline, budget, and resources needed.
4. **Create a mockup of your product.**
   - A mockup is a physical representation of your product that can be used to test its form and function. Creating a mockup is a great way to get feedback on your product concept and design before you start developing your actual prototype.
5. **Develop your prototype.**
   - Once you have created a mockup of your product, you can start developing your actual prototype. This process can be complex and time-consuming, so it is important to follow your prototype plan closely.

6. Test your prototype.

- Once your prototype is complete, it is time to test it to ensure that it meets your customer's needs and expectations. Testing can be done through focus groups, surveys, or user testing.

7. Make revisions to your prototype.

- Based on the feedback you receive from testing, you may need to make revisions to your prototype. Revisions can be small or large, but they should be made with the goal of improving the quality and innovation of your product.

8. Launch your product

- After you have developed and tested your prototype, it is time to launch your product! This is the exciting part where all of your hard work comes to fruition. Be sure to promote your product well so that customers are aware of its release

10		**Analyze the elements of a business model created through design thinking, using real-world company examples.**	**[L4, CO6]**	**[10M]**

- Design thinking helps companies put the customer at the center of everything they do. Instead of building a business model based on assumptions or internal goals alone, design thinking starts with empathy — understanding the real needs, pains, and desires of users.
- This customer-first approach leads to more relevant, practical, and innovative business models that are more likely to succeed in the market.

Design Thinking Builds Customer-Focused Business Models

a. Empathy-Driven Approach

- Design thinking begins with deep research into customers' needs and challenges. This insight helps businesses build models that truly solve real problems.

- **Example:** Airbnb founders spent time with hosts and travelers to understand their fears and desires. This empathy helped shape a peer-to-peer model built on trust, safety, and simplicity.

b. Ideation around Pain Points

- Using brainstorming and ideation tools, companies generate innovative solutions to customer problems. These ideas are then mapped into business model components -like revenue streams, value propositions, and key partnerships.
- **Example:** Uber reimagined taxi services by identifying customer frustrations such as long wait times, lack of transparency, and cash-only payments and created a model around convenience, real-time tracking, and digital payments

c. Rapid Prototyping and Feedback

- Companies use low-cost experiments like mock-ups, landing pages, or MVPs (Minimum Viable Products) to test parts of their model directly with customers.
- **Example:** Dropbox launched with just a short video explaining its idea. The overwhelming interest confirmed a real demand before they invested heavily in infrastructure.

d. Iterative Business Model Development

- Design thinking encourages continuous improvement of the business model. Customer feedback is constantly used to refine the offer, pricing, delivery, and customer support.
- **Example:** Spotify began as a free music streaming prototype, then iterated its model to include freemium and premium versions based on user listening habits.

Key Components Influenced by Design Thinking

- Value Proposition – Clearly solves a customer pain or meets a need.
- Customer Segments – Defined based on real user behaviors and needs.
- Channels – Designed for customer convenience (e.g., mobile-first).
- Revenue Model – Aligned with what customers are willing to pay for.
- Customer Relationships – Based on trust, support, and personalization.

Real-World Success Examples

Company	Customer Focused Strategy Using Design Thinking
Airbnb	Built trust-driven model by deeply understanding hosts & guests.
Apple	Designs products that combine aesthetics with intuitive user needs.
Zappos	Created a service model that emphasized happiness and support.
Nike	Used customer feedback to launch customizable shoes via NikeID.

11 **Describe the future of design thinking in business and strategic innovation?** **[L2, CO6]** **[10M]**

- Design thinking has already transformed how businesses solve problems and innovate. As we move into a more complex, fast-changing world, the future of design thinking lies in becoming a core driver of business strategy, sustainability, digital transformation, and human-centered innovation.
- It will move beyond just product design to deeply influence organizational culture, leadership, and system-level thinking.

Future Directions of Design Thinking

a. Integration into Strategic Planning

- In the future, design thinking will be embedded not just in R&D or innovation teams, but also in boardroom decisions. Companies will use design thinking to reimagine business models, customer journeys, and digital ecosystems.
- **Example:**IBM has embedded design thinking into their strategic operations, using it to shape cloud services, AI tools, and client solutions.

b. **AI and Tech-Enhanced Design Thinking**

- As AI, big data, and machine learning grow, future design thinking processes will be supported by data-driven insights. Tools like user behavior analytics will fuel better empathy and prototyping.
- **Example:** Netflix uses design thinking supported by AI to refine content recommendations and user experiences.

c. **Sustainable and Inclusive Innovation**

- Design thinking will increasingly focus on solving global challenges — such as climate change, social inequality, and resource management. Businesses will adopt circular economy models and build solutions that are environmentally conscious and inclusive.
- **Example:** IKEA uses design thinking to design affordable, sustainable furniture and reduce packaging waste.

d. **Cross-Disciplinary Collaboration**

- Design thinking will become a common language across different departments like finance, HR, marketing, and tech, promoting collaborative innovation. Businesses will break silos and encourage multidisciplinary teams to co-create solutions

e. **Human-Centered Digital Transformation**

- As digital transformation accelerates, design thinking will ensure that humans remain at the core. It will help businesses develop technologies that are empathetic, ethical, and accessible.
- **Example:** Google uses design sprints — a design thinking-based method — to quickly test new digital services while keeping the user at the center.

Long-Term Benefits

- More resilient and adaptive strategies
- Increased customer loyalty and engagement
- Greater innovation agility
- Improved employee participation and morale
- Better handling of uncertainty and complexity

Challenges and Opportunities

- Businesses will need to train leaders and employees in design thinking mindset.
- Adapting to remote and global collaboration using virtual design thinking tools.
- Embedding it as a cultural foundation, not just a project methodology.

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR-517 583												
Year & Sem: **II B. Tech II-Semester**	**OBJECTIVE TYPE UNIT-I**										Max. Marks 10	
Subject:	Branch:										Marks Obtained	
Date & Time:	Sign. of the invigilator:											
Name of the Student:	Roll No											

Answer all the questions
Write all the Answers in CAPITALS only

1	What is the primary goal of design thinking?	**[B]**
	A) Maximizing profits B) Solving Complex Problems C) Following Predefined process D) Minimizing risks	
2	Which of the following principles are not considered for design thinking?	**[C]**
	A) Embrace Experimentation B) Human-centric design C) Profit-centric experiences D) Pattern identification for problem solving	
3	Design Thinking typically helps in ……	**[A]**
	A) Innovation B) Data Analytic C) Financial Planning D) Operational Efficiency	
4	Shape is a ---------- enclosed space that represents either an organic space or geometric space	**[B]**
	A) ID B) 2D C) 3D D) None	
5	Form refers to …… shapes, creating depth and volume in a design	**[B]**
	A) ID B) 2D C) 3D D) None	
6	……refers to the lightness or darkness of a colour	**[A]**
	A) Value t B) Space C) Texture D) Line	
7	…… is a path created by a moving point	**[D]**
	A) Value t B) Space C) Texture D) Line	
8	……..refers to the surface quality of a design	**[C]**
	A) Value t B) Space C) Texture D) Line	
9	……. refers to the visual response of the eye:	**[A]**
	A) Value t B) Space C) Texture D) Colour	
10	…… refers to the distribution of visual weight in a design	**[A]**
	A) Balance B) Contrast C) Emphasis D) Movement	
11	……..refers to the visual difference between elements	**[B]**
	A) Balance B) Contrast C) Emphasis D) Movement	
12	…… refers to highlighting a focal point to attract the viewers attention	**[C]**
	A) Balance B) Contrast C) Emphasis D) Movement	
13	……..refers to guiding the viewers eye through the design using lines	**[D]**
	A) Balance B) Contrast C) Emphasis D) Movement	
14	…… is the repetition of visual movement	**[A]**
	A) Rhythm B) Unity C) Proportion D) Variety	
15	…….refers to harmony between the elements that creates a cohesive design	**[B]**
	A) Rhythm B) Unity C) Proportion D) Variety	
16	…….refers to the relationship between one part of a design and another part of a design	**[C]**
	A) Rhythm B) Unity C) Proportion D) Variety	
17	……..refers to the use of diverse elements to a design interesting and engaging	**[D]**
	A) Rhythm B) Unity C) Proportion D) Variety	
18	…….. is the most basic element of design, representing a single location in space	**[A]**
	A) Dot B) Line C) Shape D) Form	
19	Design thinking is a problem approach that focus on understanding user's ……	**[B]**
	A) Profit B) Need's C) Time D) Zone	
20	Applications of design thinking is	**[D]**
	A) Product development B) Business strategy C) Health care D) All the above	

21	Design thinking is a ---------approach.	**[C]**
	A) Educational B) Social C) Problem solving D) None of these	
22	What the primary focus of design thinking?	**[C]**
	A) Profit generation B) Technological advancement C) Human centered D) market strategies	
23	Which of the following is NOT a stage in design thinking process?	**[C]**
	A) Empathize B) Define C) Calculate D) Prototype	
24	Which organization is credited with popularizing design thinking?	**[B]**
	A) Apple B) IDEO C) NASA D) Microsoft	
25	In which stage design thinking are a wide range of creative solutions generated?	**[A]**
	A) Ideate B) Define C) Empathize D) Test	
26	Who is considered as early pioneers of design thinking with his book THE SCIENCES OF THE ARTIFICIAL?	**[B]**
	A) Tim Brow B) HerbertA.Simon C) David Kelley D) Don Norman	
27	In --------- Decade did design thinking begin to take shape as a formal approach to problem Solving	**[D]**
	A) 1920s-1930s B) 2000s-2001s C) 1980s-1990s D) 1950s-1960s	
28	Which is the following NOT a principle of design thing?	**[C]**
	A) User-centered focus B) Iterative process C) Linear convolution D) Collaborative teamwork	
29	Design thinking encourages solutions that are:	**[B]**
	A) technically complex B) User desirable & feasible C) Financially driven only D) Expert design without user input	
30	During -------phase are brainstorming and creative idea generation emphasized?	**[C]**
	A) Empathize B) Define C) Ideate D) Test	
31	The First phase of design thinking is	**[A]**
	A) Empathize B) Ideate C) Define D) Prototype	
32	The institution that helped bring design thinking into education at global level	**[C]**
	A) MIT media lab B) Harvard business school C) Standfordd.school D) Yale school of art	
33	The founder of both IDEO and standard d. school is	**[C]**
	A) BillMoggridge B) Don Norman C) David Kelley D) Larry page	
34	The design thinking originally evolve from the field of	**[B]**
	A) Philosophy B) Industrial design& architecture C) Marketing D) Computer science	
35	When IDEO was founded through the merger of several design firms?	**[A]**
	A) 1991 B) 1985 C) 2000 D) 2010	
36	The design thinking tool that generate many ideas in short time period	**[B]**
	A) Prototyping B) Brainstorming C)Interviewing D)Wireframe	
37	.----------stage of design thinking is product development most directly involved	**[D]**
	A) Empathize B) Define C) Ideate D) Test & Implement	
38	The tool that builds a simple low-cost version of product to test with users	**[C]**
	A) Person B) Brainstorming C) Prototyping D) None of the above	
39	Persona represents a ---------- character that embodies the traits of a target user	**[A]**
	A) Fictional B) Good C) Worst D) Rough	
40	Which of the following tools helps identify pain points in user's experience with a product or service	**[B]**
	A) Persona B) Customer journey map C) Brainstorming D) SWOT Analysis	

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR-517 583												
Year & Sem: **II B. Tech II-Semester**	**OBJECTIVE TYPE UNIT-II**											Max. Marks 10
Subject:	Branch:											Marks Obtained
Date & Time:	Sign. of the invigilator:											
Name of the Student:	Roll No											

Answer all the questions
Write all the Answers in CAPITALS only

1	Which is the first stage of the design thinking process?	**[B]**
	A) Ideate B) Empathize C) Prototype D) Analyze)	
2	What is the purpose of the empathize stage?	**[C]**
	A) Develop the final product B) Understand the problem technically C) Understand user needs and experiences D) Build a business model	
3	In design thinking, a persona is used to:	
	A) Market the product B) Represent a fictional user C) Replace surveys D) Analyze profits	
4	Which stage focuses on generating as many solutions as possible?	**[C]**
	A) Empathize B) Define C) Ideate D) Prototype	
5	What tool helps visualize the customer's experience with a product?	**[B]**
	A) Flowchart B) Journey Map C) Blueprint D) Canvas	
6	Brainstorming is mainly used in which stage?	**[D]**
	A) Prototype B) Empathize C) Define D) Ideate	
7	In the prototype phase, you:	**[B]**
	A) Gather data B) Build models of solutions C) Design business logos D) Write final code	
8	Which of the following is not a phase in design thinking?	**[C]**
	A) Test B) Prototype C) Visualize D) Define	
9	A journey map includes:	**[A]**
	A) User actions and emotions B) Company profits C) Advertisement plans D) Market shares	
10	Design thinking is best described as:	**[B]**
	A) Linear and technical B) Flexible and human-centered C) Theoretical and fixed D) Only used in IT	
11	What is the goal of the Define stage?	**[C]**
	A) Create many ideas B) Analyze feedback C) Identify key problem D) Launch product	
12	Inventions inspired by user needs come from:	**[B]**
	A) Market analysis B) Design thinking C) Random ideas D) Engineering only	
13	In design thinking, testing helps to:	**[B]**
	A) Sell prototypes B) Validate and refine ideas C) Launch products D) Cut costs	
14	The Ideate phase encourages:	**[D]**
	A) Selecting one best idea B) Creating 2-3 solutions only C) Judging ideas early D) creative thinking	
15	Social innovation through design thinking focuses on:	**[A]**
	A) User-centered societal solutions B) Technical apps only C) Government-only policies D) Business profits	
16	Who are typically involved in empathy interviews?	**[C]**
	A) Investors B) Designers C) End users D) Managers	
17	Design thinking helps in driving inventions by:	**[C]**
	A) Avoiding market research B) Ignoring users C) Understanding user pain points D) Following trends blindly	
18	Which of the following is a tool used in design thinking?	
	A) SWOT B) Gantt Chart C) Persona D) ERP	**[C]**
19	The costumer journey map helps identify:	**[B]**
	A) Product pricing B) Pain points and opportunities C) Salary gaps D) Market regulations	
20	What does a prototype help you do?	**[C]**
	A) Finalize the design B) Test assumptions quickly C) Estimate profit D) Avoid failure	

21	What phase allows refinement of multiple ideas?	**[A]**
	A) Test B) Empathize C) Define D) Sell	
22	Brainstorming avoids:	**[A]**
	A) Judgment of ideas B) Creativity C) Group work D) Feedback	
23	Design thinking is especially useful in:	**[C]**
	A) Financial calculations B) Algorithm design C) Human-centered problem-solving D) Budgeting	
24	Empathizing with users involves:	**[B]**
	A) Assumptions B) Interviews and observations C) Financial planning D) Technical design	
25	A persona typically includes:	**[A]**
	A) User's age, goals, frustrations B) Company statistics C) Profit estimates D) Launch schedules	
26	A prototype should be	**[C]**
	A) Perfect and polished B) Expensive C) Quick and low-cost D) Printed only	
27	Testing in design thinking includes:	**[B]**
	A) Final user delivery B) Feedback and improvement C) Ignoring flaws D) Selling immediately	
28	How is empathy different from sympathy?	**[C]**
	A) They are the same B) Empathy is emotional C) Empathy involves deeper understanding D) Sympathy is better	
29	Design thinking is applied in:	**[B]**
	A) Only engineering B) All fields including education, health, business C) Only product design D) Only marketing	
30	Which tool provides a snapshot of a user’s behavior?	**[B]**
	A) Flowchart B) User persona C) Sales graph D) Test report	
31	What is the main output of the ideation phase?	**[B]**
	A) Market analysis B) Many potential solutions C) The final prototype D) Business model	
32	The final goal of design thinking is to:	**[C]**
	A) Make profits B) Meet technical standards C) Create user-friendly solutions D) Replace traditional methods	
33	The Define stage involves turning insights into:	**[C]**
	A) Code B) Problems C) Point of view statements D) Budgets	
34	A tool that allows teams to see steps taken by a user is:	**[B]**
	A) Persona B) Journey map C) Business report D) SWOT	
35	What promotes divergent thinking?	**[A]**
	A) Brainstorming B) Budgeting C) Editing D) Filtering	
36	Design thinking encourages:	**[C]**
	A) Critical judgment first B) Fixed paths C) Iteration and flexibility D) Ignoring users	
37	What’s the final test of a solution in design thinking	**[C]**
	A) Sales B) Market share C) User experience D) Funding	
38	Testing allows designers to	
	A) Skip ideation B) Confirm usability C) Avoid updates D) End process	**[B]**
39	Design thinking starts with:	**[C]**
	A) Design B) Budget C) User D) Market	
40	The prototype should be used to:	**[B]**
	A) Finalize aesthetics B) Learn and test C) Print product D) Cut costs	

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR-517 583												
Year & Sem: **II B. Tech II-Semester**	**OBJECTIVE TYPE UNIT-III**										Max. Marks 10	
Subject:	Branch:										Marks Obtained	
Date & Time:	Sign. of the invigilator:											
Name of the Student:	Roll No											

Answer all the questions
Write all the Answers in CAPITALS only

1	How does creativity impact problem-solving?	**[C]**
	A) It leads to more complex problems B) It provides a single solution C) It generates multiple innovative solutions D) It ignores the problem	
2	What is the value of creativity in personal development?	**[B]**
	A) It limits personal growth B) It enhances critical thinking and self-expression C) It focuses on traditional methods D) It reduces confidence	
3	How does creativity contribute to economic growth?	**[C]**
	A) By reducing innovation B) By increasing unemployment C) By driving innovation and entrepreneurship D) By decreasing productivity	
4	Which of the following innovation strategies involves creating new markets or disrupting existing ones?	**[B]**
	A) Incremental innovation B) Radical innovation C) Open innovation D) Closed innovation	
5	What is the role of prototyping in innovation?	**[B]**
	A) To create a final product B) To test and refine ideas C) To launch a product in the market D) To create a detailed business plan	
6	Business cases developed through design thinking are:	**[C]**
	A) Ignored in final decision-making B) Written by external consultants only C) Based on user empathy and prototyping D) Only focused on profits	
7	Design thinking encourages what type of approach to problem-solving?	**[D]**
	A) Traditional and fixed B) Linear and rigid C) Mechanical and repetitive D) Creative and iterative	
8	Which of the following is a principle that redefines business using design thinking?	**[C]**
	A) Predictive modeling B) Cost minimization C) Action-oriented mindset D) Risk avoidance	
9	Human-centric design focuses on:	**[A]**
	A) End user's needs and experiences B) Increasing technical complexity C) Business profit D) Reducing employee count	
10	Which of the following is a key characteristic of innovative companies?	**[C]**
	A) Risk aversion B) Hierarchical decision-making C) Encouraging experimentation and learning D) Focus on short-term gains	
11	Which is the single most important driver of innovation (Gerad J. Tellis 2013) in a business firm?	**[D]**
	A) Labour B) Capital C) Government D) Culture	
12	Various forms of expression of creativity in childhood is:	**[D]**
	A) Dramatic Play B) Constructive Play C) Humor D) All of the above	
13	What is the favourable conditions of creativity:	**[D]**
	A) Positive social attitude B) Independent family environment C) Social facilitation D) All of the above	
14	According to draver what are the kinds of aesthetic imagination?	**[C]**
	A) Artistic Imagination B) Phantastic Imagination C) Artistic & Phantastic imagination	
15	Characteristic of creativity is:	**[D]**
	A) Way of Thinking B) Goal directed C) Unique D) All of the above	
16	Which of the following is an essential characteristic of creativity?	**[A]**
	A) Divergent thinking B) Impulsiveness C) Centration in thought D) Convergent thinking	
17	Fluency, elaboration and flexibility are characteristics of:	**[C]**
	A) Egocentricism B) External motivation C) Creativity D) Functional fixedness	
18	Which of these would not normally be considered an incremental innovation?	**[A]**
	A) An electric car B) A low fat hamburger C) Faster train journey's through better signaling D) An electric bike	

19	Running a hospital booking system that reduces patient waiting time is an example of which kind of innovation?	**[A]**
	A) Process B) position C) product D) paradigm	
20	Which of the following is not an example for product innovation?	**[D]**
	A) A new toothpaste B) a new car design C) A new version of the iPod D) Computer-control of manufacturing operations	
21	What is creativity?	**[B]**
	A) Following established patterns and norms B) The ability to generate original and valuable ideas or expressions C) Rigid adherence to rules and guidelines D) A form of repetition and imitation	
22	Which of the following is a key characteristic of creativity?	**[C]**
	A) Repetition B) Conformity C) Originality D) following instructions	
23	What does divergent thinking refer to?	**[C]**
	A) The ability to focus on a single solution to a problem B) The tendency to avoid risk and uncertainty C) The generation of multiple ideas and possibilities D) The reliance on preconceived notions and beliefs	
24	How can curiosity foster creativity?	**[C]**
	A) By limiting exploration and seeking the familiar B) By avoiding new experiences and knowledge C) By encouraging exploration and seeking new knowledge D) By being content with the status quo	
25	Which of the following is a benefit of creativity in problem-solving?	**[C]**
	A) Reinforcing existing solutions B) Avoiding new and innovative ideas C) Finding unique and effective solutions to challenges D) Encouraging stagnation and resistance to change	
26	What role does flexibility play in creative thinking?	**[C]**
	A) Limiting the range of possible solutions B) Encouraging rigidity and adherence to established methods C) Opening up new possibilities and approaches D) Focusing solely on a single solution	
27	How does creativity differ from conformity?	**[C]**
	A) Conformity involves generating novel ideas, while creativity follows established patterns B) Conformity encourages risk-taking, while creativity avoids uncertainty C) Creativity fosters innovation, while conformity adheres to existing norms D) Creativity and conformity are synonymous terms.	
28	Which element of creativity involves the generation of a large number of ideas or solutions?	**[A]**
	A) Fluency B) Conformity C) Rigidity D) Risk-taking	
29	In which domain is creativity NOT applicable?	**[D]**
	A) Science B) Art C) Business D) Following established guidelines	
30	An essential and typical identifying characteristic of creativity is :	**[A]**
	A) Convergent thinking B) Originality of ideas C) Preference for repeating tasks	
31	An identifying feature of creativity is:	**[C]**
	A) Conformity B) Convergent thinking C) Divergent thinking D) Hypothetico-deductive reasoning	
32	Which of the following is an essential characteristic of creativity?	**[A]**
	A) Divergent thinking B) Impulsiveness C) Centration in thought D) Convergent thinking	
33	Creativity in a classroom can be encouraged by providing for students towards:	**[B]**
	A) Join special achievement sections B) Encouraging original discovery and thinking	
34	Creativity in usually associated with:	**[D]**
	A) Hyperactivity B) Low Comprehension C) Convergent thinking D) Divergent thinking	
35	The thinking process involved in productivity of an idea or concept that is new, original and useful is termed as what?	**[A]**
	A) Creativity B) Achievement C) Intelligence D) Personality	
36	The degree to which an innovation is difficult to adopt is called:	**[B]**
	A) Observability B) Complexity C) Compatibility D) Trialability	
37	Adopter categories are the characteristics of the individuals within a social system on the basis of:	**[B]**
	A) Rate of adoption B) Innovativeness C) Social system D) None	
38	What is the primary benefit of creativity in business?	**[C]**
	A) Increased efficiency B) Improved productivity C) Innovation and competitive advantage D) reduced cost	
39	What is the role of creativity in driving social change?	**[B]**
	A) It maintains the status quo B) It challenges existing norms and promotes progress	
40	What is the impact of creativity on teamwork and collaboration?	**[C]**
	A) It creates conflict B) It hinders communication C) It fosters diverse perspectives and ideas D) It limits individual contributions	

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR-517 583												
Year & Sem: **II B. Tech II-Semester**	**OBJECTIVE TYPE UNIT-IV**											Max. Marks 10
Subject:	Branch:											Marks Obtained
Date & Time:	Sign. of the invigilator:											
Name of the Student:	Roll No											

Answer all the questions

Write all the Answers in CAPITALS only

1	What is the primary goal of product design?	**[C]**
	(A) To create aesthetically pleasing products (B) To maximize the profit margin of a product (C) To solve user problems and address their needs (D) To utilize the latest technology in product development.	
2	Which of the following is a core principle of user	**[C]**
	(A) Focusing solely on the technical feasibility of the product (B) Prioritizing the business goals above user needs (C) Understanding and incorporating the needs and feedback of the end (D) Minimizing the time and resources spent on research.	
3	Which of the following is NOT typically considered a key aspect of product design?	**[D]**
	(A) Functionality (B) Usability (C) Aesthetics (D) Manufacturing cost analysis	
4	The product design process is generally:	**[C]**
	(A) Linear process with clearly defined steps followed in order (B) A rigid process that does not allow for changes or iterations (C) An iterative process involving testing and refinement based on feedback (D) A purely creative process driven solely by the designer's vision.	
5	Which stage of the product design process typically involves understanding the issues and needs of the target users?	**[C]**
	(A) Ideation (B) Prototyping (C) Discovery (D) Testing	
6	Creating early versions of a product to test and gather feedback is known as:	**[C]**
	(A) Brainstorming (B) Sketching (C) Prototyping (D) Finalization	
7	Which of the following principles focuses on ensuring a product is easy to understand and use?	**[C]**
	(A) Accessibility (B) Consistency (C) Usability (D) Aesthetics	
8	Considering the visual appeal and overall look and feel of a product falls under which aspect of product design?	**[C]**
	(A) Functionality (B) Usability (C) Aesthetics (D) Ergonomics	
9	Which of the following is a benefit of effective product design?	**[A]**
	(A) Stronger brand recognition (B) Decreased user satisfaction (C) Increased production costs (D) Limited market appeal	
10	Which of the following roles primarily focuses on the overall experience users have while interacting with a product?	**[D]**
	(A) Industrial Designer (B) UI Designer (C) Software Engineer (D) UX Designer	
11	What is the primary purpose of a product strategy?	**[B]**
	(A) To define the daily tasks of the product development team (B) To provide a high-level plan for achieving the product vision and goals (C) To create a detailed list of product features for the next release (D) To manage the marketing and sales campaigns for the product.	
12	Which of the following is a key component typically included in a product strategy?	**[A]**
	(A) Target audience and value proposition (B) Detailed technical specifications (C) Daily sprint schedules (D) Individual performance reviews of team members	
13	A product strategy that focuses on offering the lowest price in the market is known as a:	**[C]**
	(A) Differentiation strategy (B) Focus strategy (C) Cost strategy (D) Quality strategy	
14	A product strategy that focuses on offering the lowest price in the market is known as a:	**[A]**
	(A) Differentiation strategy (B) Focus strategy (C) Cost strategy (D) Quality strategy	
15	Targeting a specific segment of the market with products tailored to their needs is characteristic of a:	**[B]**
	(A) Cost strategy (B) Focus strategy (C) Innovation strategy (D) Market leader strategy	
16	Which type of product strategy emphasizes superior quality and reliability, often commanding a higher price point?	**[B]**
	(A) Cost strategy (B) Quality strategy (C) Product-led growth strategy (D) Challenger strategy	
17	A product strategy where the product itself is the primary driver of user acquisition and growth is called:	**[C]**
	(A) Service strategy (B) Innovation strategy (C) Product-led growth strategy (D) Market leader strategy	

18	Which of the following is NOT a typical benefit of having a well	**[B]**
	(A) Improved team alignment and focus (B) Reduced need for market research (C) Better decision-making regarding product development (D) Increased chances of product success in the market	
19	The long-term aspiration for the product and its desired impact is best described as the:	**[C]**
	(A) Product roadmap (B) Product backlog (C) Product vision (D) Key performance indicators (KPIs)	
20	Regularly reviewing and adapting the product strategy is important because:	**[C]**
	(A) It ensures the development team always has new tasks (B) The initial strategy is always perfect and needs no changes (C) Market conditions, customer needs, and the competitive landscape can change (D) It allows for micromanagement of the product development process	
21	Which of the following is a primary component of a product strategy?	**[B]**
	A) Detailed product specifications B) A clear vision of the product's long-term goals C) An accurate budget estimate for product manufacturing D) The choice of design tools to be used.	
22	In product strategy, the 'value proposition' refers to:	**[B]**
	A) The cost of materials used in the product B) The unique benefits that the product offers to consumers C) The expected revenue from the product over time D) The time taken for the product to reach market.	
23	What is the purpose of creating a product roadmap?	**[B]**
	A) To define the technical specifications of the product B) To map out the entire development and launch process of the product C) To conduct user testing and feedback collection. D) To create the marketing campaign for the product	
24	In product planning, what is typically done during the risk management phase?	**[C]**
	A) Defining the user requirements for the product B) Allocating resources for production. C) Identifying potential challenges and preparing solutions D) Developing the final prototype	
25	A product specification document includes which of the following?	**[B]**
	A) Financial projections for the product's success B) Detailed features and functionality of the product C) Marketing strategies and target audience D) Employee roles and responsibilities for product launch.	
26	In a product specification, "compliance" refers to:	**[B]**
	A) The product's ability to be manufactured in bulk B) Meeting industry standards and regulations C) How the product fits within the marketing strategy D) The product's final price point in the market.	
27	Which of the following is an example of a cross-functional team involved in the product design process?	**[C]**
	A) A group of designers working independently on visual elements B) A marketing team focusing only on advertisements C) A collaboration between designers, engineers, and marketing experts D) A product manager working alone to outline features.	
28	In product design, what is the main focus of user experience (UX)?	**[C]**
	A) The aesthetics of the product B) How the product looks to consumers C) How intuitive and easy the product is to use D) How much the product costs to make	
29	The first step in problem formation during product design is to:	**[B]**
	A) Brainstorm solutions for the product B) Analyze the needs of the end users C) Start building prototypes of the product D) Conduct a market survey about similar products	
30	What is a key element in defining the scope of a product design problem?	**[B]**
	A) Establishing user personas B) Identifying all the potential solutions available C) Recognizing the constraints and limitations of the project D) Ignoring user feedback to avoid confusion.	
31	Which of the following methods is commonly used in problem formation?	**[C]**
	A) Sketching B) Ideation C) Empathy mapping D) Prototyping	
32	In product design, what does the term "prototype" refer to?	**[B]**
	A) The final product B) A rough model of a product used to test concepts C) A marketing strategy D) A customer feedback tool	
33	In the context of product strategy, what does the term 'MVP' stands for?	**[A]**
	A) Minimum Viable Product B) Maximum Value Proposition C) Market Value Product D) Most Valuable Player	
34	What kind of feedback is crucial during the prototyping phase of design thinking?	**[C]**
	A) Financial feedback B) Expert opinions C) User feedback D) Delivery feedback	
35	What is the primary goal of product planning in design thinking?	**[B]**
	A) To maximize profits B) To understand user needs and solve problem C) To conduct market research D) To set production timelines	
36	A product specification helps ensure that:	**[B]**
	A) The product is finished on time B) Stakeholders have different expectations C) The product meets user needs D) Only technical aspects are considered	
37	Which phase of the design thinking process involves generating a wide range of ideas?	**[B]**
	A) Empathize B) Define C) Ideate D) Prototype	
38	Which of the following is NOT a typical method used in the ideation phase of design thinking?	**[C]**
	A) Brainstorming B) Storyboarding C) Research analysis D) Mind mapping	

39	What is the primary purpose of modeling in design thinking?	**[B]**
	A) To create final products B) To visualize and iterate on ideas C) To collect customer feedback D) To conduct market research	
40	Which type of model is most commonly used in the ideation phase of design thinking?	**[C]**
	A) Physical prototype B) Storyboard C) Business plan D) Market analysis	

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR-517 583												
Year & Sem: **II B. Tech II-Semester**	**OBJECTIVE TYPE UNIT-V**										Max. Marks 10	
Subject:	Branch:										Marks Obtained	
Date & Time:	Sign. of the invigilator:											
Name of the Student:	Roll No											

Answer all the questions

Write all the Answers in CAPITALS only

1	Which design thinking approach is best suited to address the challenge of predictability?	**[C]**
	A) Prototyping B) Storytelling C) Strategic foresight D) Experience design	
2	To tackle the challenge of maintaining relevance, businesses should focus on:	**[C]**
	A) Sense-making B) Standardization C) Value redefinition D) Strategic foresight	
3	Strategic innovation through design thinking helps in:	**[A]**
	A) Redefining business models B) Reducing labor C) Hiring staff D) Expanding warehouse space	
4	Design Thinking applied in business results in:	**[C]**
	A) Standard routines B) Reduced communication C) Innovative solutions D) Predictable workflows	
5	Which of these is not a component of strategic innovation?	**[C]**
	A) Implementation B) Ideation C) Devaluation D) Visioning	
6	Which of the following tools can be used for process modeling in BPM?	**[B]**
	A) Google Sheets B) BPMN, Lucidchart, Bizagi C) Canva and Photoshop D) WordPress and Wix	
7	Design thinking helps in handling extreme:	**[C]**
	A) Outsourcing B) Profits C) Competition D) Taxes	
8	Design thinking principles aim to:	**[C]**
	A) Avoid customer interaction B) Maintain bureaucracy C) Redefine business challenges	
9	Business process models help stakeholders by:	**[C]**
	A) Replacing decision-making B) Automating complex systems C) Facilitating shared understanding D) Reducing the number of employees	
10	Standardization as a business challenge refers to:	**[A]**
	A) Uniformity and consistency B) Unique solutions C) Customer segmentation D) Personalized services	
11	Maintaining relevance in business means:	**[B]**
	A) Avoiding market changes B) Adapting to customer needs C) Reducing innovation D) Standardizing products only	
12	Which of these is a business challenge?	**[B]**
	A) Relaxation B) Growth C) Elimination D) Silence	
13	Predictability in business relates to:	**[C]**
	A) Random operations B) Fluctuating performance C) Reliable outcomes D) Uncertain revenues	
14	Extreme competition encourages businesses to:	**[B]**
	A) Reduce branding B) Stand out with unique value C) Ignore customer demands D) Avoid innovation	
15	Design thinking for startups helps with:	**[A]**
	A) Creating disruptive models B) Hiring employees C) Importing goods D) Reducing customer feedback	
16	Design thinking meets corporate needs by:	**[D]**
	A) Replacing human input B) Ignoring market research C) Reducing product testing D) Encouraging collaboration and feedback	
17	Design thinking supports businesses in:	**[A]**
	A) Defining and testing business models B) Managing legal cases C) Avoiding customer support D) Decreasing product variety	

18	Which is part of redefining business through design thinking?	**[A]**
	A) Creative experimentation B) Conventional wisdom C) Redundant workflows D) Standard accounting methods	
19	Design thinking is most useful in addressing:	**[D]**
	A) Production delays B) Human resource issues C) Tax compliance D) Uncertain market demands	
20	Business cases developed through design thinking are:	**[C]**
	A) Ignored in final decision-making B) Written by external consultants only C) Based on user empathy and prototyping D) Only focused on profits	
21	Design thinking encourages what type of approach to problem-solving?	**[D]**
	A) Traditional and fixed B) Linear and rigid C) Mechanical and repetitive D) Creative and iterative	
22	Which of the following is a principle that redefines business using design thinking?	**[C]**
	A) Predictive modeling B) Cost minimization C) Action-oriented mindset D) Risk avoidance	
23	Human-centric design focuses on:	**[A]**
	A) End user's needs and experiences B) Increasing technical complexity C) Business profit D) Reducing employee count	
24	The dynamic, constructive nature of design thinking means it is:	**[A]**
	A) Iterative and evolving B) Ignoring feedback C) One-time process	
25	Strategic foresight in design thinking helps in:	**[B]**
	A) Planning based on fixed patterns B) Navigating future uncertainties C) Static strategy formation D) Avoiding innovation	
26	'Weak signals' in strategic foresight refer to:	**[D]**
	A) Irrelevant data B) Strong market forces C) Definite trends D) Early indicators of potential change	
27	The concept of 'sense making' in dealing with change implies:	**[A]**
	A) Building mental models B) Ignoring data C) Only analyzing reports D) Accepting chaos	
28	Maintaining relevance requires businesses to:	**[C]**
	A) Focus on internal metrics only B) Stay consistent without change C) Align with shifting customer values D) Ignore competition	
29	Experience design helps businesses:	**[D]**
	A) Commoditize their services B) Focus only on transactions C) Lower their costs D) Create meaningful user interactions	
30	Standardization can become a challenge when it:	**[D]**
	A) Reduces costs B) Optimizes workflows C) Increases efficiency D) Removes customer choices	
31	Which of the following methods is commonly used in problem formation?	**[C]**
	A) Sketching B) Ideation C) Empathy mapping D) Prototyping	
32	Prototyping in design thinking allows for:	**[B]**
	A) Iterative improvement B) Cutting testing time C) One-time design validation D) Avoiding Feedback	
33	One key benefit of developing prototypes is:	**[C]**
	A) Avoiding design iterations B) Removing end-user involvement C) Validating ideas before launch D) Reducing creativity	
34	The business model canvas includes which of the following?	**[A]**
	A) Value proposition B) Competitor tracking C) Consumer reviews D) Board decisions	
35	Customer journey mapping helps with:	**[A]**
	A) Understanding user experience B) Tracking deliveries C) Evaluating revenue D) Auditing	
36	Which of the following is a low-fidelity prototype?	**[C]**
	A) Interactive mobile app B)3D-printed product C) Hand-drawn sketches or wireframes D) Working physical model	
37	The design ladder measures:	**[D]**
	A) Employee performance B) Technical tools C) Marketing depth D) Levels of design integration in businesses	
38	One of the ten principles of design thinking is to:	**[A]**
	A) Integrate foresight B) Prioritize profit over people C) Work in silos D) Avoid empathy	
39	The 'butterfly effect' in business strategy highlights:	**[C]**
	A) The power of planning B) Predictability C) Sensitivity to initial conditions D) Standard workflows	
40	Startups differ from large organizations in design thinking due to:	**[B]**
	A) More capital B) Fewer formal processes C) Greater predictability D) More employees	