



**DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE**

**(AUTONOMOUS)**

(Approved by AICTE & Affiliated to Anna University, Chennai)

Re-Accredited by NAAC with 'A' Grade

Accredited by NBA for AERO, BME, CSE, ECE, EEE, IT & MECH.

**PERAMBALUR-621212, TAMILNADU, INDIA.**

Website: [www.dsengg.ac.in](http://www.dsengg.ac.in)



## U23ME011/ APPLIED DESIGN THINKING

### Syllabus:

<b>UNIT I / DESIGN THINKING PRINCIPLES</b>	<b>No. of Periods : 9</b>
Exploring Human-centered Design - Understanding the Innovation process, discovering areas of opportunity, Interviewing & empathy-building techniques, Mitigate validation risk with FIR [Forge Innovation rubric]- Case studies	
<b>UNIT II / END USER-CENTRIC INNOVATION</b>	<b>No. of Periods : 9</b>
Importance of customer-centric innovation- Problem Validation and Customer Discovery- Understanding problem significance and problem incidence - Customer Validation. Target user, User persona & user stories. Activity: Customer development process - Customer interviews and field visit	
<b>UNIT III / APPLIED DESIGN THINKING TOOLS</b>	<b>No. of Periods : 9</b>
Concept of Minimum Usable Prototype [MUP] - MUP challenge brief - Designing & Crafting the value proposition- Designing and Testing Value Proposition; Design a compelling value proposition; Process, tools and techniques of Value Proposition Design	
<b>UNIT IV/ CONCEPT GENERATION</b>	<b>No. of Periods : 9</b>
Solution Exploration, Concepts Generation and MUP design- Conceptualize the solution concept; explore, iterate and learn; build the right prototype; Assess capability, usability and feasibility. Systematic concept generation; evaluation of technology alternatives and the solution concepts	
<b>UNIT V/ SYSTEM THINKING</b>	<b>No. of Periods : 9</b>
System Thinking, Understanding Systems, Examples and Understandings, Complex Systems	

### Objective:

To equip students with practical knowledge and hands-on experience in applying design thinking methodologies to solve real-world problems

### Text Book:

T1: Steve Blank,(2013),The four steps to epiphany: Successful strategies for products that win, Wiley.

T2: Alexander Osterlender, Yves Pigneur, Gregory Bernard, Alan Smith, Trish Papadacos, (2014), Value Proposition Design: How to Create Products and Services Customers Want

T3:Wiley Donella H.Meadows, (2015),“Thinking in Systems-A Primer”, Sustainability Institute.

T4: TimBrown, (2012) “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Harper Business.

**U23MEO11/ APPLIED DESIGN THINKING**  
**Unit I Design Thinking Principles**

**Part A**

**1. What is the core principle of Human-centered Design (HCD)?**

The core principle of HCD is to deeply understand the needs, behaviors, and motivations of the end-users to create solutions that are desirable, feasible, and viable.

**2. Name the five phases of the traditional Design Thinking process.**

The five phases are Empathize, Define, Ideate, Prototype, and Test.

**3. Why is "Empathize" the crucial first step in Design Thinking?**

Empathize is crucial because it helps innovators set aside their assumptions and gain a deep, authentic understanding of the users' experiences, pain points, and needs, which is fundamental for creating relevant solutions.

**4. What does "understanding the innovation process" primarily involve in Design Thinking?**

It primarily involves recognizing that innovation is an iterative, non-linear journey that balances understanding user needs, technical feasibility, and business viability, moving from problem discovery to solution delivery.

**5. How does Design Thinking help in "discovering areas of opportunity"?**

By thoroughly empathizing with users and analyzing their unmet needs, frustrations, and unarticulated desires, Design Thinking helps identify overlooked problems or gaps in existing solutions that present strong opportunities for innovation.

**6. What is the primary goal of conducting user interviews in HCD?**

The primary goal of user interviews is to gather qualitative data directly from target users to understand their perspectives, experiences, motivations, and pain points in their own words.

**7. Provide an example of an open-ended question suitable for a customer interview.**

"Tell me about a time when you struggled with [specific task/problem area]." (Alternatively: "How do you currently manage X, and what are the biggest frustrations you face?")

**8. Why should interviewers avoid leading questions during customer interviews?**

Leading questions can bias the interviewee's response, causing them to confirm the interviewer's assumptions rather than revealing their true experiences or opinions, thus compromising the validity of the insights.

**9. What is "empathy-building" in the context of Design Thinking?**

Empathy-building is the process of putting yourself in the user's shoes, understanding their emotions, perspectives, and experiences to genuinely connect with their needs and challenges.

**10. Give one practical technique for building empathy during a field visit.**

Active listening to users' stories and observing their behaviors in their natural environment, noting down not just what they do, but how they feel and why they do it. (Alternatively: Shadowing users as they perform tasks.)

**11. What is the purpose of a "User Persona" in Design Thinking?**

A User Persona is a semi-fictional, archetypal representation of a target user, based on research, that helps teams humanize users and maintain a consistent understanding of their needs and motivations.

**12. How does prototyping help mitigate validation risk?**

Prototyping allows for quick, low-cost testing of ideas with real users, providing early feedback to validate assumptions and identify flaws before significant resources are invested in full development.

**13. What is "validation risk" in the context of innovation?**

Validation risk is the risk that a proposed solution, feature, or business model will not be accepted or valued by the target customers or market, leading to failure or wasted resources.

**14. What does FIR stand for in "Mitigate validation risk with FIR"?**

FIR stands for Forge Innovation Rubric.

**15. How does the Forge Innovation Rubric (FIR) aid in mitigating validation risk?**

FIR provides a structured framework or set of criteria to systematically evaluate and score the robustness of an innovation's underlying assumptions, particularly regarding desirability, feasibility, and viability, thus highlighting areas of high risk for further validation.

**16. Briefly explain the concept of "iteration" in the innovation process.**

Iteration refers to the cyclical process of repeatedly refining ideas, prototypes, and solutions based on feedback and learning from testing, leading to continuous improvement and better fit with user needs.

**17. Why are "Field Visits" valuable for understanding human-centered design?**

Field visits allow innovators to observe users in their natural context, revealing unspoken behaviors, environmental influences, and real-world challenges that might not emerge in a structured interview.

**18. What kind of insights can observing non-verbal cues provide during an interview?**

Non-verbal cues (e.g., body language, tone of voice, hesitations) can provide insights into a user's true feelings, discomfort, enthusiasm, or underlying emotions that their verbal responses might not fully convey.

**19. What is a "pain point" in the context of user needs?**

A pain point is a specific problem, frustration, or difficulty that a user experiences when trying to achieve a goal or complete a task.

**20. Give an example of how a case study contributes to understanding Design Thinking principles.**

A case study demonstrates how real companies or projects applied Design Thinking principles (e.g., empathizing with users, iterating prototypes) to solve a specific problem, illustrating the practical application and benefits of the methodology.

**Part B**

1. Elaborate on the concept of Human-centered Design (HCD). Discuss its foundational principles and explain how it fundamentally shifts the approach to innovation compared to traditional methods.

2. Describe the five phases of the Design Thinking process in detail. For each phase, explain its purpose and outline the key activities involved. Provide examples of tools or techniques commonly used in each stage.

3. The "Empathize" phase is considered the cornerstone of Human-centered Design. Justify this statement by explaining the critical role of empathy in the innovation process. Discuss various techniques used for empathy-building and their respective benefits.

4. Effective interviewing is crucial for successful customer discovery. Discuss the best practices for conducting user interviews, including question formulation, active listening, and managing the interview flow. How do these practices contribute to gathering actionable insights for innovation?

5. Field visits and contextual inquiry provide invaluable insights into user behavior. Compare and contrast the insights gained from structured customer interviews versus observational field

visits. Explain why both methods are necessary for a holistic understanding in Human-centered Design.

6. Innovation is not merely about generating new ideas, but about discovering genuine "areas of opportunity." Explain how a deep understanding of human needs and pain points, coupled with Design Thinking methodologies, facilitates the identification of these valuable opportunities. Illustrate with an example.

7. Mitigating validation risk is paramount in innovation. Explain what validation risk entails and why it is a significant concern for new products or services. Discuss how the principles and activities of Human-centered Design, particularly prototyping and testing, directly help in reducing this risk.

8. Describe the Forge Innovation Rubric (FIR) and its role in systematically mitigating validation risk. Explain the key dimensions or criteria that FIR typically evaluates, and how a rigorous application of such a rubric can guide decision-making throughout the innovation process.

9. Select a well-known case study (e.g., Airbnb, Uber, IDEO's work, Apple's early iPhone). Analyze how the principles of Human-centered Design were applied in its development. Focus on how understanding user needs led to significant innovation and successful market adoption.

10. The innovation process is often described as iterative and non-linear. Discuss the implications of this characteristic for teams practicing Design Thinking. How does this iterative nature, supported by continuous learning and feedback loops, contribute to more robust and user-centric solutions?

## **UNIT II / End User-Centric Innovation**

### **21. What is customer-centric innovation?**

It is the process of designing products or services around users' needs, preferences, and problems, focusing on creating value for customers rather than just for the business.

### **22. Why is customer-centric innovation important for startups?**

It increases product-market fit, builds stronger customer relationships, gives a competitive advantage, and improves retention rates by focusing on solving real user problems.

### **23. What is problem validation?**

Problem validation is confirming, through research and direct user engagement, that a recognized problem genuinely exists and is significant for the target audience.

**24. How does customer discovery differ from customer validation?**

Customer discovery seeks to deeply understand the target customer and their pain points (problem identification), while customer validation tests if users accept and value the proposed solution (solution fit).

**25. What does “problem significance” mean in user-centric innovation?**

It refers to how important or impactful a problem is for stakeholders, factoring in its severity and strategic importance.

**26. What is meant by “problem incidence”?**

Problem incidence is the frequency with which a problem occurs for users, helping determine how widespread and urgent the issue is.

**27. List two methods for problem validation.**

Customer interviews and direct field observations.

**28. Why is customer validation critical before product launch?**

It ensures that the solution addresses a real need, minimizing the risk of poor adoption and wasted resources.

**29. Define ‘target user’ in innovation.**

The specific user segment or group whose needs and behaviors are prioritized during product development.

**30. What is a user persona?**

A detailed, fictional representation of an ideal user, based on real data about user demographics, motivations, and behaviors.

**31. Give one use of user personas in product development.**

They help guide design and feature decisions, ensuring solutions align with genuine user needs and preferences.

**32. What is a user story?**

A simple, user-focused statement capturing a need or goal ("As a [user], I want [goal], so that [reason]") used to guide development priorities.

**33. Why are field visits conducted during customer development?**

To observe real user behavior in context and uncover needs or pain points that may not be evident in interviews.

**34. Name two data collection techniques used in customer interviews.**

Open-ended questioning and note-taking/audio recording.

**35. How does analyzing problem incidence help in prioritizing solutions?**

Frequent problems are more urgent, so analyzing incidence helps target resources toward the most pressing issues.

**36. What is the primary goal of the customer development process?**

To systematically discover, validate, and refine both real user problems and effective solutions before scaling.

**37. Give an example of a company benefiting from customer-centric innovation.**

Slack built its workplace communication platform by actively using and iterating features based on user feedback.

**38. What risks arise from ignoring customer validation?**

Developing products with low adoption, missing real user priorities, and incurring wasted investment.

**39. How do analytics support customer validation?**

By providing quantitative insights into how users engage with prototypes or MVPs, highlighting real usage patterns.

**40. State one benefit of using user stories in product teams.**

They help maintain user focus across the team and clarify what features provide real user value.

**Part B**

1. Explain the significance of customer-centric innovation in modern business. Illustrate your answer with real-world examples of organizations that successfully use customer-centric approaches to create sustainable competitive advantage.
2. Critically analyze the stages of the customer development process, with a focus on the role and methodology of customer interviews and field visits. Discuss how these activities contribute to identifying and validating user needs.

3. Discuss the concepts of problem significance and problem incidence in user-centric innovation. How do these dimensions influence the prioritization of product development efforts? Support your discussion with practical examples.
4. Describe the process and importance of problem validation in the context of customer discovery. Evaluate different methods of validating whether a problem is both real and significant to the target user.
5. With reference to a specific product or service, outline the full customer validation process. Explain how this process ensures alignment between the product, user needs, and market demand.
6. Define and distinguish between target user, user persona, and user stories. Analyze how each tool contributes to creating effective, user-driven innovation strategies.
7. Critically evaluate the role of user personas in product design and development. How are user personas constructed, and what are their limitations?
8. User stories are widely used in agile product development. Explain the structure, purpose, and benefits of user stories. Illustrate how user stories transform user needs into actionable development tasks.
9. Discuss the challenges and ethical considerations involved in conducting customer interviews and field visits in the customer development process. Suggest strategies for mitigating bias and ensuring accurate data collection.
10. Suppose you are launching a new technology product. Develop a detailed plan for conducting customer discovery and validation, from initial hypothesis to actionable insights. Include specifics on how you would use field visits, interviews, data analysis, and persona creation throughout the process.

### **UNIT III / APPLIED DESIGN THINKING TOOLS**

#### **☒ Minimum Usable Prototype (MUP) & MUP Challenge**

Q1. What is a Minimum Usable Prototype (MUP)?

A: A Minimum Usable Prototype is the simplest version of a product that demonstrates the core functionality and allows real user testing.

Q2. What is the main purpose of developing an MUP?

A: The purpose is to validate ideas quickly, test user reactions, and minimize cost and time before full-scale development.

Q3. How does MUP differ from an MVP (Minimum Viable Product)?

A: MUP focuses on usability and functionality testing, while MVP focuses on market validation and business viability.

Q4. What are the key characteristics of a good MUP?

A: It is simple, user-focused, functional, low-cost, and allows feedback collection.

Q5. What is an MUP Challenge?

A: It is an exercise or activity where teams create quick, functional prototypes to test ideas and present them for feedback or evaluation.

Q6. Why is user feedback important in the MUP stage?

A: It helps identify usability issues, refine product features, and align with customer needs.

Q7. Mention one tool commonly used for developing prototypes.

A: Tools like Figma, Sketch, or Canva are often used for digital prototypes.

Q8. What is the first step in an MUP challenge?

A: Understanding the problem statement and defining user needs.

Q9. What type of prototype is preferred in an MUP challenge?

A: Low-fidelity prototypes that are quick to build and easy to modify.

Q10. How does MUP support innovation?

A: It encourages experimentation, learning from failure, and refining ideas before scaling up.

## ▣ Designing & Crafting the Value Proposition

Q11. What is a Value Proposition?

A: A value proposition is a clear statement that explains how a product solves customer problems and delivers specific benefits.

Q12. What are the key components of a Value Proposition?

A: Customer segment, problem, solution, and unique benefit.

Q13. Why is crafting a value proposition important?

A: It helps communicate the unique value of a product and attract the right customers.

Q14. What tool is used to design a value proposition?

A: The Value Proposition Canvas is the most common tool.

Q15. What are the two main sections of the Value Proposition Canvas?

A: Customer Profile and Value Map.

## ▣ Designing and Testing Value Proposition

Q16. What is the purpose of testing a value proposition?

A: To verify if customers truly value and are willing to pay for the proposed solution.

Q17. Name one method used to test a value proposition.

A: Customer interviews, surveys, or prototype testing.

Q18. What does customer feedback reveal during value proposition testing?

A: Whether the product meets real needs and expectations.

## ▣ Process, Tools & Techniques of Value Proposition Design

Q19. Mention any two tools used in value proposition design.

A: Empathy Map and Value Proposition Canvas.

Q20. What is the final outcome of the Value Proposition Design process?

A: A validated product concept that aligns with customer needs and business goals.

## Unit 4 - CONCEPT GENERATION

### □ Solution Exploration and Conceptualization

Q1. What is Solution Exploration?

A: Solution Exploration is the process of identifying and examining multiple possible ways to solve a defined problem.

Q2. Why is concept exploration important in design thinking?

A: It helps generate a wide range of ideas and avoid settling on the first or obvious solution.

Q3. What is meant by conceptualizing the solution concept?

A: It means forming a clear idea or model of how the proposed solution will function and deliver value.

Q4. What are the key activities involved in conceptualization?

A: Brainstorming, sketching ideas, visual mapping, and defining user experience flow.

Q5. What is the main goal of solution conceptualization?

A: To transform abstract ideas into tangible, testable solution concepts.

### □ Concept Generation and Iteration

Q6. What is concept generation?

A: It is the systematic process of creating, collecting, and refining multiple ideas to address a specific problem.

Q7. What are the common techniques used in concept generation?

A: Brainstorming, SCAMPER, mind mapping, and morphological analysis.

Q8. What does “systematic concept generation” mean?

A: It refers to a structured approach that combines creativity with logic to develop and evaluate multiple solution ideas.

Q9. Why is iteration important in design?

A: Iteration allows designers to refine ideas based on testing, feedback, and learning from earlier versions.

Q10. What is the purpose of exploring, iterating, and learning?

A: To progressively improve the design and ensure the final concept meets user needs and technical requirements.

## □□ MUP Design and Prototyping

Q11. What is the focus of MUP (Minimum Usable Prototype) design?

A: To create a basic but functional model that demonstrates the core features of a concept for testing.

Q12. What are the benefits of building an early prototype?

A: It helps visualize the idea, identify issues early, and gather user feedback.

Q13. What does “build the right prototype” mean?

A: It means developing a prototype that tests key assumptions and solves the critical part of the problem.

Q14. What are the three aspects evaluated in a prototype?

A: Capability, usability, and feasibility.

Q15. What is usability in prototype evaluation?

A: Usability measures how easy and effective it is for users to interact with the prototype.

□ Evaluation and Feasibility Analysis

Q16. What is meant by capability assessment?

A: It checks whether the proposed solution can perform the required functions effectively.

Q17. What is feasibility assessment?

A: It determines whether the solution can be practically implemented within technical, financial, and time constraints.

Q18. Why is evaluating technology alternatives necessary?

A: To select the most suitable and sustainable technology for the proposed solution.

Q19. What factors are considered while evaluating solution concepts?

A: Performance, cost, reliability, scalability, and user acceptance.

Q20. How does concept evaluation support decision-making?

A: It helps in selecting the best concept based on criteria like feasibility, desirability, and viability.

## Unit 5

### Part A:

#### 1. What is System Thinking?

System Thinking is an approach to understanding how different parts of a system interact and influence each other. Instead of analyzing components separately, it focuses on the whole system, identifying patterns, relationships, and feedback loops to solve complex problems effectively.

---

#### 2. Define a system.

A system is a collection of interconnected elements working together to achieve a common goal. These elements may include people, processes, and resources that interact within defined boundaries and produce outputs from given inputs.

---

#### 3. What are the key components of a system?

The key components of a system include inputs, processes, outputs, feedback, and environment. Inputs are resources, processes transform inputs, outputs are results, feedback helps improve performance, and the environment influences system functioning.

---

#### 4. What is feedback in a system?

Feedback is the information returned to a system about its performance. It helps the system adjust and improve its operations. Feedback can be positive (reinforcing change) or negative (correcting deviations).

---

#### 5. Explain open and closed systems.

An open system interacts with its environment by exchanging information, energy, or matter. A closed system operates independently without external interaction. Most real-world systems are open systems.

---

#### 6. What is a boundary in a system?

A boundary defines the limits of a system and separates it from its environment. It determines what is included inside the system and what lies outside, helping in system analysis and understanding.

---

#### 7. What is system thinking approach?

The system thinking approach focuses on understanding relationships and interactions among system components rather than analyzing them individually. It emphasizes holistic analysis and long-term solutions.

---

#### 8. What are subsystems?

Subsystems are smaller parts of a larger system that perform specific functions. They are interconnected and contribute to the overall functioning of the main system.

---

#### 9. What is a complex system?

A complex system consists of many interconnected components whose interactions are dynamic and unpredictable. These systems often exhibit non-linear behavior and cannot be easily understood by analyzing individual parts alone.

---

**10. Give an example of a system.**

An example of a system is a human body, where organs like the heart, lungs, and brain work together to maintain life. Each part has a specific function but is interdependent.

---

**11. What is interdependence in systems?**

Interdependence means that different parts of a system rely on each other to function effectively. A change in one component affects other components within the system.

---

**12. What is system environment?**

The system environment includes all external factors that influence the system's functioning. It may include social, economic, or physical conditions affecting system performance.

---

**13. What is a dynamic system?**

A dynamic system changes over time due to internal and external influences. These systems are constantly evolving and adapting to new conditions.

---

**14. What is leverage point in system thinking?**

A leverage point is a place within a system where a small change can produce significant improvements. Identifying leverage points helps in solving complex problems efficiently.

---

**15. What is system behavior?**

System behavior refers to how a system acts or responds over time. It is influenced by internal interactions and external conditions.

---

**16. What is emergence in complex systems?**

Emergence refers to new patterns or behaviors that arise from interactions among system components. These behaviors cannot be predicted by analyzing individual parts alone.

---

**17. What is causal loop?**

A causal loop is a diagram that shows relationships between variables in a system. It illustrates cause-and-effect links and feedback loops.

---

**18. What is system failure?**

System failure occurs when a system cannot perform its intended function. It may result from poor design, lack of coordination, or external disturbances.

---

**19. What is resilience in systems?**

Resilience is the ability of a system to recover from disturbances and continue functioning. It ensures system stability under changing conditions.

---

**20. What is holistic thinking?**

Holistic thinking involves analyzing a system as a whole rather than focusing on individual components. It helps in understanding the bigger picture and solving complex problems effectively.

**Part B:**

1. Explain the concept of System Thinking in detail with suitable examples.
2. Describe the components of a system and explain how they interact with each other.
3. Discuss the characteristics and behavior of complex systems with real-life examples.
4. Explain different types of systems and their significance in system thinking.
5. Analyze the importance of feedback and causal loops in system thinking with examples.