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School of Engineering & Technology
Department of CSE
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Lecture Notes

Unit I: Design Thinking

1. Introduction to Design Thinking

- **Definition:** Design Thinking is a human-centered approach to innovation that focuses on understanding the user's needs, exploring solutions, and iterating based on feedback.
- **Traditional Problem Solving vs. Design Thinking:**
 - **Traditional Problem Solving:** Often linear, focuses on solving predefined problems with established methods.
 - **Design Thinking:** Iterative, empathetic, and user-centered; involves understanding the problem from the user's perspective and involves experimentation.
- **History:**
 - Originated in the 1960s from industrial design and evolved through contributions from designers like Herbert Simon, David Kelley, and Tim Brown.
 - Gained prominence in the 1990s and 2000s through design consultancies like IDEO and Stanford's school.
- **Wicked Problems:**
 - Characteristics include complexity, ambiguity, and no definitive solution. Examples: climate change, public health issues.
 - Requires flexible, iterative solutions and stakeholder involvement.

2. Innovation and Creativity

- **Role in Organizations:**
 - Drives competitive advantage, fosters growth, and improves efficiency.
 - Encourages adaptation to market changes and fosters new product development.
- **Creativity in Teams and Environments:**
 - **Team Dynamics:** Diverse teams can lead to more innovative solutions.
 - **Environment:** Open, collaborative environments support creative thinking.
- **Design Mindset:**
 - Embraces empathy, experimentation, and a focus on user needs.
 - Encourages learning from failures and iterating designs.

3. Elements and Principles of Design

- **Elements of Design:**
 - **Line:** Defines shapes and contours; can be straight, curved, or irregular.
 - **Shape:** Geometric or organic forms that occupy space.
 - **Color:** Affects mood and perception; includes hue, saturation, and brightness.
 - **Texture:** Surface quality that can be tactile or visual.
 - **Space:** The area around and between objects; can be positive (occupied) or negative (empty).
 - **Form:** Three-dimensional equivalent of shape.
- **Principles of Design:**

- **Balance:** Distribution of visual weight; symmetrical or asymmetrical.
- **Contrast:** Differentiation between elements; highlights differences.
- **Emphasis:** Focus on specific elements to attract attention.
- **Movement:** The path the viewer's eye follows through the design.
- **Pattern:** Repeated elements to create rhythm.
- **Rhythm:** Repeating patterns to create visual tempo.
- **Unity:** Cohesiveness; all elements work together harmoniously.

4. Musical Notes for Design Mindset

- A metaphorical framework representing different aspects of a design mindset, such as empathy, iteration, and collaboration.

5. Examples of Great Design

- **Case Studies:** Examples include Apple's product design, IKEA's flat-pack furniture, and Tesla's electric vehicles.
- **Criteria:** Effective problem-solving, user-centered design, and innovation.

6. Design Approaches Across the World

- **Cultural Perspectives:** Different regions may have unique design approaches influenced by local culture, resources, and traditions.
- **Global Design Trends:** Emphasis on sustainability, inclusivity, and technological integration.

Unit II: Pattern Breaking

1. Understanding Humans

- **Combination of I (Self) and Body:**
 - **Self:** Personal identity, beliefs, and desires.
 - **Body:** Physical needs and how they influence behavior.
- **Basic Needs:**
 - **Maslow's Hierarchy of Needs:** Physiological, safety, love/belonging, esteem, self-actualization.
- **Desires vs. Actualization:**
 - **Desires:** Aspirations and wants.
 - **Actualization:** Achieving or realizing one's potential and goals.

2. Understanding Culture

- **In Family, Society, Institutions:**
 - **Family:** Influences early development and values.
 - **Society:** Shapes norms, behaviors, and expectations.
 - **Institutions:** Educational, governmental, and corporate influences.
- **Startups and Socialization:**
 - **Startups:** Emphasis on innovation, risk-taking, and agility.
 - **Socialization:** Process of integrating into society and organizational culture.

3. Ethical Behavior

- **Effects on Self and Society:**
 - **Self:** Personal integrity and self-respect.
 - **Society:** Trust, fairness, and social cohesion.
- **Core Values and Feelings:**
 - **Core Values:** Principles guiding behavior.
 - **Feelings:** Emotional responses to ethical dilemmas.
- **Definite Human Conduct:**
 - Universal goals include safety, fairness, and respect.
- **Developing Human Consciousness:**
 - **Values, Policy, Character:** Building a framework for ethical decision-making.

4. Stakeholders and Empathy

- **Techniques to Empathize:**
 - **Interviews:** Direct conversations to gather insights.
 - **Empathy Maps:** Visual tools to understand user perspectives.
 - **Emotional Mapping:** Tracking user emotions throughout their journey.
 - **Immersion and Observations:** Engaging with users to observe behaviors and needs.
 - **Customer Journey Maps:** Visual representation of user interactions and pain points.
- **Classifying Insights:** Organizing observations to identify key user problems.
- **Classifying Stakeholders:** Identifying and understanding different stakeholders' roles and needs.
- **Do's & Don'ts for Brainstorming:**
 - **Do's:** Encourage wild ideas, build on others' ideas, and stay focused on the topic.
 - **Don'ts:** Avoid criticism, limit participants' creativity, or focus on feasibility too early.
- **Individual Activity - Moccasin Walk:**
 - **Moccasin Walk:** Experience a problem from the user's perspective by physically or mentally stepping into their shoes.

Unit III: Design for Innovation

1. Defining the Problem Statement

- **Creating Personas:**
 - **Personas:** Fictional characters representing different user types based on research.
- **Point of View (POV) Statements:**
 - **POV Statements:** Define the user's needs and insights in a clear, concise manner.

2. Research

- **Identifying Drivers:** Factors that influence user behavior and needs.

- **Information Gathering:** Collecting data through surveys, interviews, and observations.
- **Target Groups and Samples:** Defining the audience for research and selecting representative samples.
- **Feedbacks:** Gathering and analyzing feedback to refine solutions.

3. Idea Generation

- **Basic Design Directions:** Initial concepts and directions for design.
- **Themes of Thinking:** Major ideas or themes guiding the design process.
- **Inspiration and References:** Sources of ideas and influences.
- **Brainstorming:** Generating a wide range of ideas through collaborative sessions.
- **Inclusion:** Ensuring diverse perspectives are considered.
- **Sketching and Presenting Ideas:** Visualizing concepts and communicating them effectively.
- **Idea Evaluation:** Assessing ideas based on feasibility, desirability, and viability.

4. Design Methods

- **Double Diamond Approach:**
 - **Discover, Define, Develop, Deliver:** A framework for managing the design process.
- **Analyzing - Four W's, 5 Whys:**
 - **Four W's:** Who, What, Where, When.
 - **5 Whys:** Asking “Why” repeatedly to uncover root causes.
- **“How Might We” Questions:**
 - Framing challenges as opportunities for innovation.
- **Defining the Problem Using Ice-Cream Sticks:**
 - **Ice-Cream Sticks:** A creative exercise to explore and define problems.
- **Metaphor & Random Association Technique:**
 - Using unrelated concepts to stimulate new ideas.
- **Mind Mapping:**
 - Visual tool for organizing and exploring ideas.
- **Ideation Activity Games:**
 - **Six Thinking Hats:** A technique for exploring different perspectives.
 - **Million-Dollar Idea:** Generating high-value ideas through brainstorming.

5. Visual Collaboration Tools

- **Mural, JamBoard:** Digital platforms for collaborative brainstorming and idea visualization.

Unit IV: Critical Thinking

1. Fundamental Concepts

- **Difference Between Critical and Ordinary Thinking:**
 - **Critical Thinking:** Involves analysis, evaluation, and logical reasoning.

- **Ordinary Thinking:** More surface-level and less analytical.
- **Characteristics of Critical Thinkers:**
 - Open-minded, reflective, and analytical.
- **Critical Thinking Skills:**
 - **Linking Ideas:** Connecting concepts logically.
 - **Structuring Arguments:** Building coherent and persuasive arguments.
 - **Recognizing Incongruences:** Identifying inconsistencies in reasoning.

2. Five Pillars of Critical Thinking

- **Clarity:** Ensuring arguments are easily understood.
- **Accuracy:** Verifying information is correct.
- **Precision:** Providing detailed and specific information.
- **Relevance:** Ensuring information is pertinent to the argument.
- **Depth:** Addressing complexities and nuances.

3. Argumentation vs. Rhetoric

- **Argumentation:** Reasoned discussion based on evidence and logic.
- **Rhetoric:** Persuasive techniques that may rely on emotional appeals.

4. Cognitive Biases and Fallacies

- **Tribalism and Politics:** How biases influence reasoning.
- **Logical Fallacies:** Errors in reasoning such as ad hominem attacks, false dilemmas, etc.
- **Case Study:** Applying critical thinking to real-world scenarios to identify biases and fallacies.

Unit V: Systematic Inventive Thinking

1. Argument Structure

- **Claims, Premises, and Conclusions:**
 - **Claims:** Assertions or statements.
 - **Premises:** Supporting reasons or evidence.
 - **Conclusions:** Logical outcomes based on premises.
- **Truth and Logic Conditions:**
 - Evaluating arguments based on truthfulness and logical structure.

2. Logical Reasoning

- **Deductive and Inductive Arguments:**
 - **Deductive:** General to specific conclusions.
 - **Inductive:** Specific observations to general conclusions.
- **Argument Diagrams:**
 - Visual tools for illustrating and analyzing arguments.

3. Scientific and Logical Reasoning

- **Logical Fallacies:** Identifying errors in reasoning.
- **Propositional Logic:** Formal logic dealing with propositions and their relationships.
- **Probability and Judgment:** Assessing likelihood and making reasoned decisions.

4. Obstacles to Critical Thinking

- **Group Activity/Role Plays:** Practicing critical thinking skills by evaluating arguments and exploring different perspectives.

