Unit 5-HCI design rules, guidelines and evaluation techniques

→Elaborate User interface management system (UIMS) in detail.

i)A User Interface Management System (UIMS) is a mechanism for cleanly separating process or business logic from Graphical user interface (GUI) code in a computer program.

ii)UIMS are designed to support N-tier architectures by strictly defining and enforcing the boundary between the business logic and the GUI.

iii)A UIMS may also have libraries and systems such as graphical tools for the creation of user interface resources or data stores.

iv)Generally, you cannot easily use multiple UIMS systems at the same time, so choosing the correct model for your UIMS is a critical design decision in any project.

v)The choice of system is dependent upon the system(s) you wish to create user interfaces for, and the general style of your application.

vi)For example, if you want to create a web based front end, or just a standalone application or both that would be an important factor in choosing.

vii) If you want to deploy on MacOS, Windows or Linux, that would further influence your choice of a UIMS system.

→Explain the design standards and design Guidelines in HCI.

A] Design Standards:-

i)Design standards are established conventions, rules, or specifications that provide a set of guidelines for creating consistent and high-quality user interfaces.

ii)Ensure uniformity and consistency in design across different interfaces or applications.

iii)Example:-ISO Standards: International Organization for Standardization provides standards for various aspects of design, including usability and accessibility.

iv)Users can easily switch between applications with similar design standards, as they share common conventions.

v)Developers can follow established standards, streamlining the design and development process.

B] Design Guidelines:-

i)Design guidelines are specific recommendations or suggestions that guide designers in making informed decisions during the design process.

ii)Provide detailed advice on implementing design principles in specific contexts.
iii)Addresses common challenges and issues faced by designers in particular domains or platforms.
iv)Example:-Design Guidelines: Offered by Google, these guidelines focus on the principles and components for creating consistent and intuitive interfaces.
v)Following guidelines increases the likelihood of creating interfaces that are user-friendly and easy to navigate.

→Explain evaluation through user participation.
i)Evaluation through user participation engages end-users in assessing system usability.
ii)Methods include usability testing, focus groups, surveys, and participatory design.
iii)Benefits encompass user-centric solutions, early issue identification, and improved satisfaction.
iv)Challenges include resource intensity and ensuring a representative user sample.
v)Continuous iteration and ethical considerations are integral to this approach.
vi)Usability labs and remote testing offer controlled and real-world evaluation environments.
vii)The process ensures the system aligns with user needs, preferences, and expectations.
viii)Early involvement of users facilitates timely corrections and enhances collaboration.
ix)User participation contributes to a sense of ownership and satisfaction with the final product.

→Explain evaluation through expert analysis.
i)Evaluation through expert analysis in HCI involves usability experts assessing system usability without direct user involvement.
ii)Methods include heuristic evaluation, cognitive walkthroughs, and expert reviews.
iii)Experts apply established heuristics to identify potential usability issues and provide valuable insights.
iv)This approach is efficient and resource-effective, especially in the early stages of design.

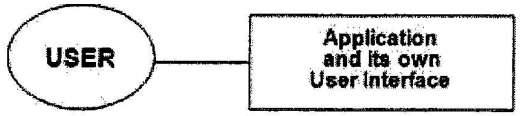
v)Heuristic evaluation involves experts systematically evaluating interfaces based on predefined usability principles.
vi)Cognitive walkthroughs simulate user tasks to assess how well the system supports users' thought processes.
vii)Expert reviews encompass a comprehensive analysis of design elements, interactions, and user interface components.
viii)Findings from expert analysis help uncover usability problems, guiding design improvements.

→Write a note on - Evaluation Criteria
i)Usability:Assessing the ease with which users can interact with the system, including factors like learnability, efficiency, and user satisfaction.
ii)Accessibility:Ensuring that the design accommodates users with diverse abilities and disabilities, providing a universally inclusive experience.
iii)Consistency:Evaluating the uniformity and consistency of design elements, interactions, and visual aesthetics throughout the system.
iv)Efficiency:Measuring the system's ability to perform tasks and deliver information promptly, minimizing user effort.
v)Learnability:Assessing how quickly users can understand and navigate the system, especially for first-time users.
vi)Engagement:Evaluating the ability of the design to captivate and maintain user interest, promoting prolonged interaction.
vii)Aesthetics:Assessing the visual appeal and design aesthetics, considering factors like color schemes, typography, and overall look and feel.
viii)Performance:Evaluating the speed, responsiveness, and efficiency of the system in delivering the desired outcomes.

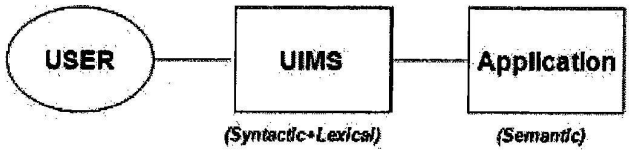
→What is Usability? Explain the principles that support usability.
i)Usability refers to the extent to which a product or system can be used by specified users to achieve specific goals with effectiveness, efficiency, and satisfaction in a specified context of use.
ii)It is a key aspect of user experience design, focusing on ensuring that users can interact with a product or system in an effective, efficient, and satisfying manner.
iii)Principles that Support Usability: Learnability, Efficiency, Satisfaction, Error Prevention, Consistency, Flexibility, Accessibility, Aesthetic Design

→Explain User Interface Management System(UIMS) conceptual architecture.

- **Before**



- **After**



→Explain Nielsen's ten heuristics.

i)Visibility of system status:-The first principle is about keeping users informed about their actions and what's happening at a given interaction.For example: when you finish watching an episode of a series on Netflix, the system provides a small screen telling you how long it will take to load the next episode.

ii)Match between system and the real world:-This principle claims that a system should always speak the user's language and follow real-world conventions.Use words, phrases, and concepts that are familiar to your target audience.

iii)User control and freedom:-A good UI design should never impose an action on the user or make decisions for them. Instead, the system should only suggest which paths the users can take.

iv)Consistency and standards:-This heuristic is about keeping the same language throughout the system to avoid confusing the user. So when users interact with a product, they should have no doubts about the meaning of words, icons, or symbols used.

v)Error prevention:-This Nielsen heuristic proposes that a good design should always prevent problems from occurring.Think of a delete files button, for example. We must assume that users might accidentally click this button or that they can imagine a different result from it.

vi)Recognition rather than recall:-As seen, Nielsen's heuristics aim to reduce users' cognitive load, and this also includes their memory capacity.So it's essential to think of ways to make options and actionable components visible; this is important because it's easier for us to recognize something rather than remember it.

vii)Flexibility and efficiency of use:-Your designs should benefit both inexperienced and experienced users.Notice that inexperienced users need more detailed information. But as they keep using a product, they become experienced users.
viii)Aesthetic and minimalist design:-As a designer, please don't consider aesthetics above functionalities.Therefore, create interactions that contain only essential information. Avoid unnecessary visual elements that can overwhelm and distract users.
ix)Help users recognize, diagnose, and recover from errors:-Your designs should help the user identify and find solutions to eventual problems and errors.
x)Help and documentation:-The last of Nielsen's heuristics concerns documentation that will help users understand how to perform their tasks.Although all the heuristics listed above are supposed to help users avoid errors and make it easy to navigate without assistance, it is still essential to provide further assistance at any given time.

→What is evaluation?
i)Evaluation, in the context of design and system development, refers to the systematic assessment and analysis of a product, interface, or system to determine its effectiveness, usability, and overall quality.
ii)It involves gathering data, insights, and feedback to understand how well a design meets its intended goals and aligns with user needs.
iii)Evaluation plays a crucial role in identifying areas for improvement and guiding the refinement of a product or system throughout its lifecycle.

→Explain cognitive walkthrough with an example.
i)A cognitive walkthrough is a usability evaluation method that involves step-by-step analysis of a user's thought processes while interacting with a system or product.
ii)The evaluator simulates the perspective of an end user, systematically assessing the system's design to identify potential usability issues.
iii)This method is particularly useful during the early stages of interface design.
iv)Example of a Cognitive Walkthrough: *Task: Add a Product to the Shopping Cart in an E-commerce App*
v)Step 1: Open the App: User Goal: Access the app easily.Thought Process: "I need to find the app on my phone. It should be visible and recognizable."Issue: If the app icon is not distinct or easily accessible, it may cause user frustration.

vi)Step 2: Navigate to Product Category:User Goal: Find the desired product category.Thought Process: "I want to browse phones, so I'll look for the 'Electronics' or 'Technology' section."Issue: If the category names are unclear or the navigation is complex, users may struggle to locate products.
vii)Step 3: Select a Product:User Goal: Choose a specific phone.Thought Process: "I like this model; I'll click to view details."Issue: If the product details are not easily accessible or if there's ambiguity, users may become frustrated.
viii)Step 4: Add to Cart:User Goal: Add the selected phone to the cart.Thought Process: "There should be a clear 'Add to Cart' button. I'll look for it after deciding."Issue: If the 'Add to Cart' button is hidden or unclear, users may struggle to complete the intended action.
ix)Step 5: View Cart and Checkout:User Goal: Review the cart and proceed to checkout.Thought Process: "I need to check the cart contents before purchasing."Issue: If accessing the cart or proceeding to checkout is not straightforward, users may abandon the process.

→Write classification of evaluation techniques.
Classification of Evaluation Techniques:
i)Quantitative vs. Qualitative: Quantitative: Numerical metrics (e.g., success rates).Qualitative: Subjective insights (e.g., user interviews).
ii)Remote vs. Local:Remote: Participants at a distance.Local: In-person evaluation.
iii)Inspection vs. User Testing:Inspection: Evaluator-focused.User Testing: User interaction-focused.
iv)Diagnostic vs. Comparative:Diagnostic: Identifies issues.Comparative: Compares designs or versions.

→Write use of a toolkit in design with an interface.
i)A toolkit in design refers to a set of resources, tools, and components that designers use to streamline the design process, maintain consistency, and enhance efficiency.
ii)Toolkit can have several valuable uses:Consistency Across Interfaces, Efficiency in design workflow, Brand Identity Maintenance, Usability, Accessibility, Iterative Design Improvement, Cross platform design.

Unit 6-HCI Models and theories

→Describe a linguistic model in detail.

i)A linguistic model is a computational framework for understanding and generating human language.

ii)It involves statistical and rule-based methods to analyze linguistic structures.

iii)It employs techniques such as natural language processing (NLP) and machine learning to comprehend syntax, semantics, and context. Linguistic models, like transformer-based architectures, capture intricate language patterns and relationships.

iv)These models utilize vast amounts of text data to learn linguistic nuances and context dependencies.

v)They power applications like chatbots, language translation, and sentiment analysis.

vi)Pre-trained linguistic models, such as BERT and GPT, have demonstrated state-of-the-art performance in various language-related tasks.

vii)Continuous training and fine-tuning optimize linguistic models for specific applications, making them versatile tools in the realm of natural language understanding.

→A Hierarchical Task Analysis (HTA) provides an understanding of the tasks users need to perform to achieve a certain goal. Perform HTA of the task to cook food(rice). Illustrate using a diagram.

Goal: Prepare Cooked Rice:-

i)Subtask 1: Measure Rice Subtask 1.1: Take measuring cup Subtask 1.2: Scoop desired amount of rice

ii)Subtask 2: Rinse Rice Subtask 2.1: Place rice in a sieve Subtask 2.2: Rinse rice under cold water

iii)Subtask 3: Add Water Subtask 3.1: Fill a pot with water Subtask 3.2: Pour water into the pot with rice

iv)Subtask 4: Set Up Cooking Subtask 4.1: Place pot on the stove Subtask 4.2: Turn on the stove

v)Subtask 5: Cook Rice Subtask 5.1: Bring water to a boil Subtask 5.2: Reduce heat and simmer

vi)Subtask 6: Monitor Cooking Subtask 6.1: Check rice occasionally Subtask 6.1: Check rice occasionally

vii)Subtask 7: Let It Rest Subtask 7.1: Turn off the stove Subtask 7.2: Allow rice to rest before serving
viii)Subtask 8: Serve Subtask 8.1: Fluff rice with a fork Subtask 8.2: Serve rice on a plate

→Explain Cognitive architectures
i)Cognitive architectures are theoretical frameworks or computational models that aim to simulate and understand the underlying structures and processes of human cognition.
ii)These architectures are designed to emulate the way the human mind processes information, learns, and makes decisions.
iii)Mimicking Human Cognition:Cognitive architectures seek to replicate aspects of human cognitive processes, including perception, memory, reasoning, and problem-solving.
iv)Information Processing:They involve computational models that represent how information is received, processed, and transformed within the system, drawing inspiration from psychological and neuroscientific principles.
v)Rule-Based and Learning Mechanisms: They incorporate rule-based systems and learning mechanisms to adapt to new information and experiences, allowing the system to improve its performance over time.
vi)Applications in AI:Cognitive architectures serve as a foundation for building intelligent systems and artificial agents capable of human-like cognitive abilities. They are used in areas such as robotics, natural language processing, and decision support systems.
vii)Cognitive architectures contribute to advancing our understanding of how the human mind works and play a crucial role in developing intelligent systems with more human-like capabilities.

→Explain three state model.
i)Input State:In the input state, the user provides input to the system. This can include actions such as clicking a button, typing on a keyboard, or interacting with any input device. The system receives and processes this input, preparing to transition to the next state.
ii)Processing State:During the processing state, the system processes the user input and performs the necessary computations or operations. This may involve executing commands, handling data, or carrying out any tasks based on the

user's input. The processing state is crucial for translating user actions into meaningful system responses.
iii)Output State:In the output state, the system presents feedback or output to the user based on the processed input. This output can take various forms, such as displaying information on the screen, providing auditory feedback, or triggering any other response that communicates the system's reaction to the user's input.
iv)The three-state model helps designers and developers conceptualize the interactive process between users and systems, providing a framework for understanding the flow of information and actions.
v)Effective user interfaces ensure smooth transitions between these states, offering responsive and intuitive interactions.

→Explain Keystroke-Level-Model(KLM).
i)The Keystroke-Level Model (KLM) is a predictive modeling technique used in human-computer interaction (HCI) to estimate the time it takes for a user to perform specific tasks based on the number of keystrokes or mouse clicks required.
ii)Developed by Stuart Card, Thomas Moran, and Allen Newell, KLM breaks down tasks into basic operations, each associated with a specific time value.
iii)KLM identifies fundamental actions, such as keystrokes or mouse clicks, as basic operations. Each operation is assigned a predetermined time value.
iv)The model uses standard time values for common operations. For example, pressing a key might take 0.2 seconds, while moving the mouse and clicking might take 1.1 seconds.
v)Tasks are decomposed into a sequence of basic operations.
vi)The total time for a task is calculated by summing the time values associated with each basic operation in the sequence. The formula is Time = Σ(Operation Time × Frequency).
vii)KLM allows designers to predict and evaluate the efficiency of different interface designs by estimating the time it takes to complete tasks.
viii)KLM is most suitable for predicting and comparing the performance of straightforward, repetitive tasks, such as those involving data entry or simple interaction sequences.

→Write a note on Ubiquitous Computing
i)Ubiquitous Computing visions a seamless integration of computing into everyday life.

ii)It focuses on making computing capabilities available, accessible anytime and anywhere.
iii)Devices and technologies become invisible, blending into the environment and minimizing user awareness.
iv)Relies on sensors, connectivity, and context-aware systems to enhance user experiences and automate tasks.
v)Envisions smart environments where computing seamlessly supports human activities without explicit user intervention.
vi)Challenges include privacy concerns, data security, and the need for efficient and reliable connectivity.
vii)Ubiquitous Computing aligns closely with the Internet of Things (IoT), fostering interconnected devices and intelligent ecosystems.
viii)Applied in smart homes, healthcare, transportation, and various industries, transforming how we interact with technology.

→How to find things on the web: Future of HCI?
The future of Human-Computer Interaction (HCI) in finding things on the web is shaped by ongoing advancements in technology and user interface design. Here are several trends and considerations:
i)Natural Language Processing (NLP):Improved NLP capabilities enable users to search using conversational language, making interactions with search engines more intuitive and human-like.
ii)Augmented Reality (AR) and Virtual Reality (VR):AR and VR technologies contribute to immersive search experiences, where users can visually explore and interact with information in virtual environments, enhancing spatial understanding.
iii)Personalized and Context-Aware Search:AI-driven systems provide more personalized search results by considering individual preferences, historical data, and contextual information, delivering tailored information based on user profiles and behaviors.
iv)Gesture-Based Interaction:Gesture recognition and touchless interfaces offer alternative ways to interact with search interfaces, allowing users to navigate and find information with physical movements.
v)Predictive Search and AI Assistants:AI-driven predictive search anticipates user needs and preferences, offering suggestions before users complete their queries. AI assistants become more proactive in delivering relevant information.

vi)Continuous Learning Interfaces:Interfaces that continuously learn from user behaviors and adapt over time enhance the efficiency and effectiveness of web search experiences.
vii)As HCI evolves, the future of finding things on the web aims to create more intelligent, personalized, and context-aware search experiences that seamlessly integrate with users' daily lives while prioritizing ethical considerations and user privacy.

→Elaborate Hierarchical task analysis (HTA).
i)Hierarchical Task Analysis (HTA) is a systematic method for decomposing complex tasks into a hierarchical structure, offering a detailed understanding of the steps involved in task completion.
ii)HTA breaks down tasks into hierarchical levels, ranging from high-level goals to detailed subtasks, creating a structured representation of the task's complexity.
iii)Tasks are decomposed into smaller, more manageable elements, facilitating the identification of dependencies, sequences, and relationships among different actions.
iv)Typically presented in a tree or diagram format, HTA visually illustrates the relationships between goals, tasks, and subtasks, aiding in communication and analysis.
v)HTA reveals decision points within a task, where users make choices or branch to different subtasks, offering insights into user decision-making processes.
vi)HTA helps assess the efficiency, effectiveness, and learnability of systems by analyzing task structures and potential improvements.
vii)Designers use HTA to optimize task workflows, ensuring that systems align with user expectations and minimizing cognitive load during task execution.
viii)HTA supports an iterative design process, allowing designers to refine task structures based on user feedback, ensuring that the final design aligns with user needs and goals.

→Discuss applications meant for computer-mediated communication.
i)Email Platforms:Facilitate asynchronous communication through electronic mail, allowing users to send and receive messages, documents, and multimedia content.
ii)Instant Messaging (IM) Apps:Enable real-time text, voice, and video communication, fostering quick and dynamic conversations among users across various devices.

iii)Video Conferencing Tools:Support virtual face-to-face meetings, enhancing remote collaboration, and enabling users to participate in discussions from different locations.
iv)Social Media Platforms:Offer diverse communication channels, including text, images, and videos, fostering social connections, information sharing, and community engagement.
v)Webinars and Webcasts:Facilitate online presentations and seminars, allowing presenters to interact with a remote audience through Q&A sessions and chat features.
vi)Podcasting Platforms:Support the creation and distribution of audio content, enabling individuals or groups to share information, stories, and discussions with a global audience.
vii)Virtual Reality (VR) Communication:Emerging applications leverage VR technology to create immersive communication experiences, allowing users to interact in virtual spaces and share experiences more intuitively.
viii)Blogs:Facilitate online presentations and seminars, allowing presenters to interact with a remote audience through Q&A sessions and chat features.

→Describe Physical and device models with examples
A] Physical Models:-
i)Physical models represent the tangible aspects of a system or object, providing a three-dimensional, often scaled, representation of its form and structure.
ii)Examples:Architecture: Scaled-down representations of buildings or structures, aiding architects and designers in visualizing and planning construction projects.
B]Device Models:-
i)Device models are abstractions or representations of electronic or mechanical devices, describing their functionalities, interactions, and components.
ii)Examples:Circuit Diagrams:Schematic representations of electronic circuits, illustrating the connections and components within electrical systems.

→Write a short note on – i. BNF(Backus-Naur-Form) ii. GOMS (GOAL,OPERATORS,METHODS AND SELECTION)
A]BNF(Backus-Naur-Form):-
i)Backus-Naur Form (BNF) is a metasyntax used to formally describe the syntax of programming languages and document the structure of context-free grammars.

ii)Introduced by John Backus and Peter Naur, BNF employs a set of production rules to define the valid combinations of symbols in a language.
iii)It consists of terminal and non-terminal symbols, where non-terminals represent syntactic categories, and terminals are the actual symbols used in the language
iv)BNF is widely used in compiler design, documentation, and the specification of programming languages.
B]GOMS (GOAL,OPERATORS,METHODS AND SELECTION):-
i)GOMS is a cognitive model used in Human-Computer Interaction (HCI) and psychology to analyze and predict user performance in interactive tasks.
ii)GOMS breaks down user tasks into four components:
iii)Goals: Describing the overall objectives users aim to achieve.
iv)Operators: Identifying the basic actions or interactions users perform to accomplish a goal.
v)Methods: Sequences of operators that users employ to achieve goals.
vi)Selection Rules: Governing the decision-making process users use to choose methods based on the task context.

→List out Diagrammatic Dialog Design notations. Explain any two with examples.
i)Flowcharts:Utilized to represent the flow of a dialog or process through various decision points and actions. Symbols like rectangles (for processes), diamonds (for decisions), and arrows (for flow) are commonly used. Useful for mapping out the sequential steps and decision points in a user's interaction, providing a clear visualization of the dialog flow.
ii)State Transition Diagrams:Depict the different states a system or dialog can be in and the transitions between these states. Circles represent states, and arrows indicate transitions. Describes the various states a system can be in and the transitions triggered by user actions, valuable for understanding the overall system behavior.
iii)Storyboarding:Visual storytelling using a sequence of images to represent the progression of a user's interaction with a system or application.
iv)Wireframes:Basic visual representation of the layout and structure of a user interface, focusing on the placement of elements without detailing visual design.
v)Entity-Relationship Diagrams (ERD):Illustrate the relationships between entities in a system, providing insights into the data structure and interactions.

→What is task action grammar?

i)Task Action Grammar (TAG) is a linguistic model applied in Human-Computer Interaction (HCI) to represent and analyze user interactions with computer systems.

ii)In essence, TAG combines linguistic structures with task analysis to understand and describe user actions in a formalized manner.

iii)TAG integrates linguistic elements, such as verbs and nouns, into a grammar framework to represent user actions.

iv)Utilizes formal grammar rules to describe the syntax and structure of user interactions, emphasizing clarity and precision.

v)Integrates task analysis methodologies to map linguistic constructs to specific actions within a given task.

vi)Often applied in the design of dialogue systems to facilitate natural and task-oriented interactions between users and machines.

vii)Aims for more intuitive and effective user experiences.

viii)Supports user-centered design by providing a structured framework for designing interfaces based on linguistic models of user behavior.