UNIT–1 : Foundations of HCI (PYQ Solution)

PART–A Answers (≈70 Words Each)

Q1. What is meant by Human-Computer Interaction? (2022)

Human-Computer Interaction (HCI) is the study of how people interact with computers and the design of interfaces that make that interaction effective, efficient and satisfying. It combines computer science, psychology, ergonomics and graphic design.

Q2. What are the goals of design? (2022)

The goals of design are to make a system:

- **Useful: it supports the user's real tasks**
- **Usable: easy to learn and use**
- **Safe: prevents errors and allows recovery**
- **Efficient and satisfying: low effort and pleasant to use**

Q3. Define usability. (2024)

Usability is the extent to which specified users can achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use (ISO 9241-11). Nielsen adds learnability, memorability and low error rate.

Q4. What is the role of user research in interactive system design? (2024)

User research finds out who the users are, what tasks they perform and in what context. Using interviews, observation, questionnaires and contextual inquiry, it gives designers real needs, so the design is based on evidence and not on assumptions, reducing costly redesign.

Q5. What is user interface? (Feb 2024)

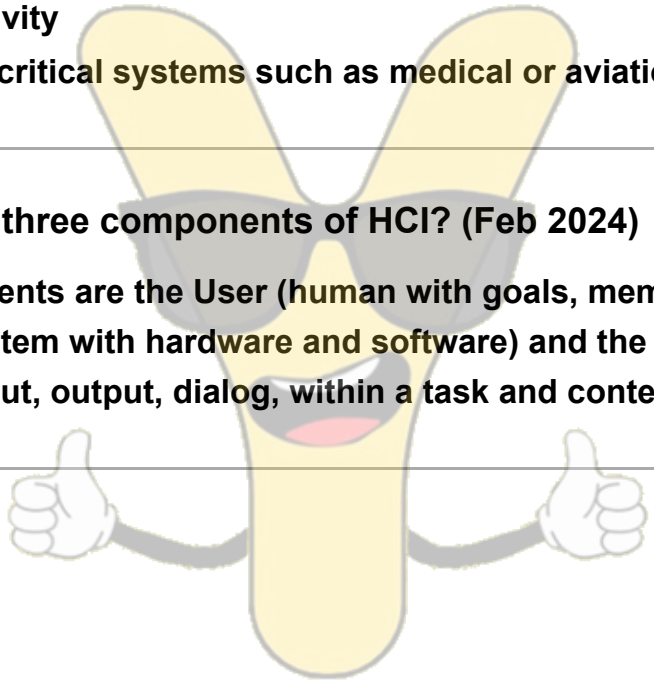
The user interface (UI) is the means by which a user and a system exchange information. It consists of input devices (keyboard, mouse, touch), output displays and the dialog between them, for example menus, windows and buttons.

Q6. What are the various difficulties with poor design? (Feb 2024)

- **Users make errors and lose data or time**
- **Frustration, stress and abandonment of the product**
- **High training and support cost**
- **Lower productivity**
- **Safety risks in critical systems such as medical or aviation software**

Q7. What are the three components of HCI? (Feb 2024)

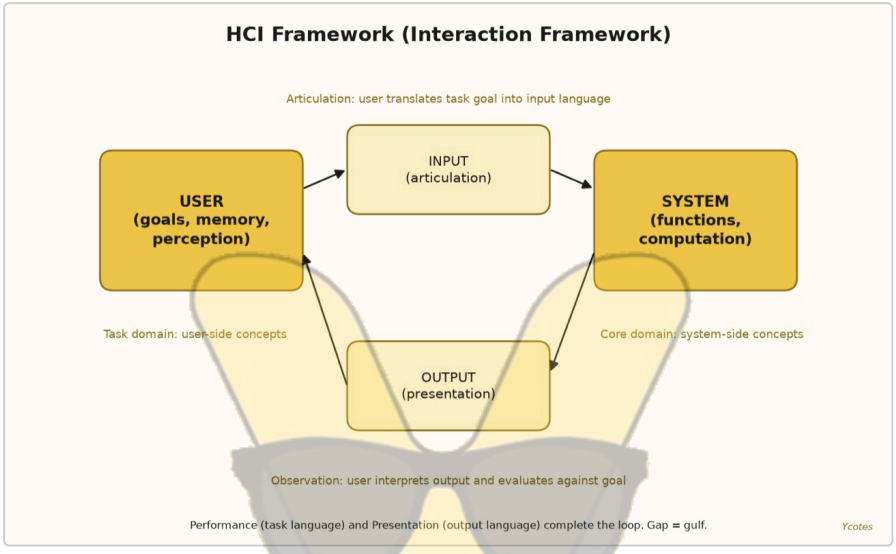
The three components are the User (human with goals, memory, perception), the Computer (system with hardware and software) and the Interaction between them (input, output, dialog, within a task and context).



PART–B Answers (≈250 Words Each)

Q1. Draw the block diagram representing Human-Computer Interaction framework and discuss it. (2022)

The interaction framework of Abowd and Beale has four components: **User (U), Input (I), System (S) and Output (O)**.



Each component has its own language. Interaction is a cycle of four translations:

1. **Articulation:** the user's task language is translated into the input language (typing, clicking)
2. **Performance:** the input is translated into the system's core language (the system executes it)
3. **Presentation:** the new system state is translated into the output language (display)
4. **Observation:** the user reads the output and translates it back into the task language, to judge the goal

If any translation is difficult, a gap (gulf) appears between the user's intention and the system. A good design keeps all four translations short and natural, with the interface language close to the user's task language. The framework helps designers locate where a usability problem arises.

Q2. Discuss in detail about GUI design and aesthetics. (2022)

GUI design arranges windows, icons, menus, buttons and forms so users can act on objects directly (WIMP: windows, icons, menus, pointer).

Principles of GUI design:

- Consistency of layout, terms and behaviour
- Clear visual hierarchy and grouping
- Immediate feedback for every action
- Direct manipulation and reversible actions
- Simplicity and a minimal number of choices

Aesthetics is the visual attractiveness of the interface. Pleasing interfaces are perceived as easier to use (aesthetic-usability effect) and raise user trust and satisfaction.

Element	Good practice
Colour	Limited palette, high contrast, consistent meaning, support colour-blind users
Typography	Readable fonts, enough size and spacing, few font families, clear heading levels
Imagery and icons	Meaningful, consistent style, support the text
Layout	Grid alignment, white space, group related items

A good GUI balances beauty with usability: aesthetics must never hide function.

Q3. Discuss the chronological history of graphical user interface. (Feb

2024)

Year	Milestone
1945	Vannevar Bush describes Memex (the idea of hypertext)
1963	Ivan Sutherland's Sketchpad: first graphical interaction with a light pen
1964	Douglas Engelbart invents the mouse
1973	Xerox Alto: first GUI with windows, icons and mouse
1981	Xerox Star: desktop metaphor and WYSIWYG
1984	Apple Macintosh brings the GUI to the mass market
1985	Microsoft Windows 1.0
1990s	Web browsers and hypertext interfaces
2007 onward	Multi-touch smartphones, then voice and gesture interfaces

The WIMP style grew out of Xerox PARC and has become the standard way of interacting with computers.

Q4. Discuss in brief the importance of the user interface design. (Feb 2024)

- The interface **is the product** from the user's point of view
- Good UI design reduces errors, training time and support cost
- It raises productivity, satisfaction and trust in the system
- It gives a competitive advantage and makes the system accessible to more people
- A large part of software code and effort is spent on the UI, so design quality affects the whole project
- In critical systems it improves safety

Q5. Discuss the implications of HCI for software engineering methodologies. (2024)

Usability becomes a quality requirement along with function, so HCI activities enter every phase of the software life cycle.

Phase	HCI activity
Requirements	User and task analysis, personas, scenarios
Design	Guidelines, task models, dialog design
Implementation	UI toolkits, prototypes
Testing	Usability testing, heuristic evaluation
Maintenance	User feedback, iterative redesign

Implications:

- The strictly linear waterfall model is replaced by **iterative, user-centred design** (design, prototype, evaluate, repeat)
- Users are involved from the start
- **Prototyping** (paper sketches, wireframes, interactive mock-ups) allows early testing
- Teams need usability experts beside programmers, and usability metrics become acceptance criteria

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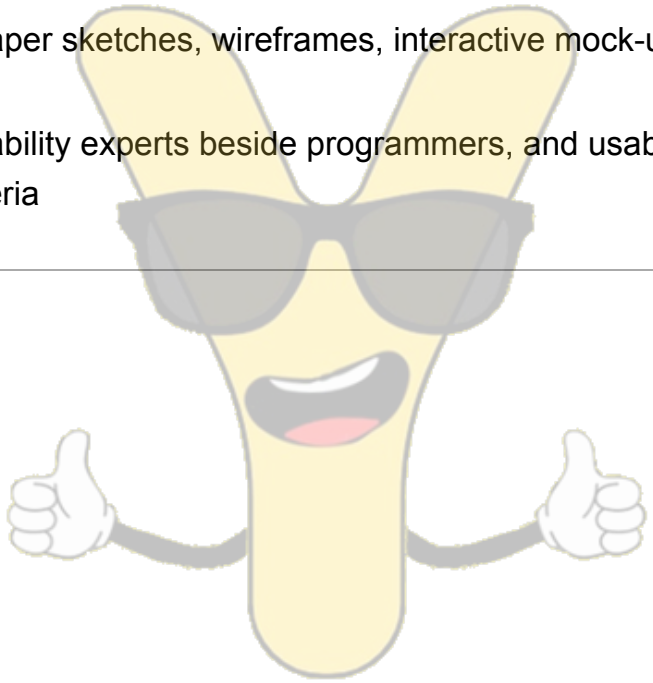

PART–C Answers (≈500 Words Each)

Q1. Discuss the role of aesthetics in GUI design, including the use of color, typography, and imagery. (2024)

Aesthetics is the visual quality of an interface. Research shows that attractive interfaces are judged as more usable and trustworthy (aesthetic-usability effect), and users tolerate small problems in them more.

Role of aesthetics:

- Creates a first impression and builds trust
- Directs attention through hierarchy and contrast
- Reduces cognitive load by organising information
- Expresses brand identity and gives satisfaction

Colour

- Use a small palette (primary, secondary, accent)
- Keep strong contrast between text and background for readability
- Use colour with meaning (red for error, green for success) and never as the only cue, because of colour blindness
- Respect cultural meanings of colours

Typography

- Choose readable typefaces and sufficient size
- Limit to two font families
- Use weight and size for heading hierarchy
- Control line length and line spacing

Imagery and icons

- Use relevant, high quality images with a consistent style
- Icons must be recognisable and, where unclear, labelled
- Do not use decoration that distracts from the task

Layout: align to a grid, use white space and group related items (Gestalt principles).

Conclusion: aesthetics and usability must be balanced; a beautiful but confusing screen fails the user.

Q2. Explain GUI design and aesthetics in detail. (Feb 2024)

GUI design is the planning of the visual and interactive elements through which a user controls a system: windows, icons, menus, pointer, buttons, text fields and dialogs.

Steps in GUI design:

1. Understand users and tasks
2. Choose the interaction style (menus, forms, direct manipulation)
3. Sketch the layout and navigation (low-fidelity prototype)
4. Apply guidelines (consistency, feedback, visibility)
5. Build a high-fidelity prototype and evaluate with users
6. Refine

Components: window, icon, menu, pointer, button, list, text box, dialog box.

Aesthetics: the pleasing visual appearance created by colour, typography, imagery, layout and white space.

Element	Guideline
Colour	Few colours, high contrast, accessible
Typography	Legible, hierarchical, consistent
Imagery	Meaningful, consistent style
Layout	Grid, alignment, grouping
Motion	Short, purposeful animation as feedback

Good GUI design makes the system learnable, efficient and enjoyable, while aesthetics increase satisfaction and trust. Both must work together.
