

COURSE TITLE	HUMAN-MACHINE INTERACTION
COURSE CODE	01AD0505
COURSE CREDITS	4

Objective:

- 1 To give students an understanding of how the study of HMI affects the design of machine systems, both hardware and software. To improve awareness of human factors that determines the usability of systems. To learn how to make GUI interfaces in at least one language.

Course Outcomes: After completion of this course, student will be able to:

- 1 Apply principles of human-machine interaction to select appropriate input/output devices and interaction techniques for various applications. (Apply)
- 2 Apply interface design principles to develop and prototype user interfaces using suitable tools such as Java. (Apply)
- 3 Analyze the components and significance of human-machine interaction to understand their impact on usability and user experience. (Analyze)
- 4 Analyze user tasks and requirements to design effective and efficient human-machine interfaces. (Analyze)
- 5 Evaluate user interfaces and product lifecycle processes using appropriate data collection and analysis techniques to improve system design and usability. (Evaluate)

Pre-requisite of course:Data structures, Java.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Introduction to Human Machine Interaction and User-Centered Design: Introduction to Human-Machine Interaction (HMI) and its interdisciplinary nature; importance of human-centered design in modern systems, concepts of usability, user experience (UX), and user satisfaction; characteristics of effective and poor interface designs with real-world examples, fundamental interaction design principles such as consistency, feedback, visibility, and affordance, stages of the interaction design process including requirement gathering, design, prototyping, and evaluation, relationship between interaction design and user experience; role of cognitive psychology and human factors in interface design.	6

Contents : Unit	Topics	Contact Hours
2	User Research and Problem Understanding: Introduction to user research methodologies, conducting user interviews and field observations, contextual inquiry techniques to understand real-world user environments; analysis of user behavior, needs, and expectations, identifying and defining the problem space, creation and use of personas and user profiles; affinity diagramming for organizing qualitative data, task analysis and user journey mapping, translating user insights into clear and actionable design requirements	7
3	Ideation and Conceptual Design: Principles of ideation and creativity in design; brainstorming techniques and collaborative idea generation, scenario-based design and storytelling methods; development of conceptual models to represent system functionality, understanding interaction paradigms (e.g., command-line, graphical, touch-based interfaces), use of design metaphors for intuitive interaction; generation of multiple design alternatives, comparative evaluation of concepts based on usability and feasibility, selection and refinement of optimal design solutions.	6
4	Prototyping and Interface Design Importance and role of prototyping in iterative design, ; types of prototypes including low-fidelity (paper sketches, wireframes) and high-fidelity (interactive digital prototypes), tools and techniques for prototyping; development of paper prototypes and wireframes, principles of graphical user interface (GUI) design such as layout, color, typography, and visual hierarchy, navigation design and structuring of user flows, information architecture for organizing content effectively, introduction to interactive prototyping tools and implementation basics	8
5	Usability Evaluation and Inclusive Design Concepts and goals of usability including efficiency, effectiveness, and satisfaction, methods of usability evaluation such as heuristic evaluation, usability testing, and cognitive walkthroughs; designing and conducting usability tests; analyzing user feedback and performance data, accessibility principles for designing inclusive systems (e.g., WCAG guidelines), inclusive design approaches for diverse user groups; ethical considerations in interaction design including privacy and bias, role of human factors and ergonomics in improving usability	7

Contents : Unit	Topics	Contact Hours
6	Design Communication, Teamwork and Design Lifecycle Preparation of design documentation including reports, wireframes, and specifications, importance of teamwork and collaboration in interaction design projects, communication of design ideas through presentations and pitching techniques, overview of iterative design lifecycle models such as Agile and user-centered design cycles; methods for incorporating user feedback into design improvements, continuous refinement and optimization of interfaces, analysis of real-world HMI case studies to understand practical challenges and solutions	6
Total Hours		40

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Practical 1 Study and analyze examples of good and poor user interface designs from real-world applications and identify usability issues based on HMI principles.	2
2	Practical 2 Conduct need finding by performing user interviews and observations for a selected application domain and document user needs and problem statements.	2
3	Practical 3 Apply affinity diagramming techniques to organize user research data and derive design insights and requirements	2
4	Practical 4 Create storyboards and scenarios to represent user interactions for a proposed interactive system	2
5	Practical 5 Design low-fidelity prototypes using paper sketches or wireframes for a selected application and evaluate them through user feedback.	2
6	Practical 6 Develop high-fidelity interactive prototypes using appropriate prototyping tools and demonstrate navigation and interface flow.	2
7	Practical 7 Perform heuristic evaluation on an existing software or web interface using standard usability heuristics and report usability problems.	2
8	Practical 8 Conduct usability testing with users, measure task completion time and errors, and analyze user performance and satisfaction.	2
9	Practical 9 Evaluate interface designs for accessibility and inclusive design principles, identifying improvements for diverse user groups.	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
10	Practical 10 Apply Fitt's Law or Hick's Law to analyze and improve the efficiency of interface components such as buttons and menus	2
11	Practical 11 Design icons, color schemes, and layout elements based on human perception and usability guidelines.	2
12	Practical 12 Prepare and present a team-based HMI design project, including design documentation, prototype demonstration, and evaluation results	2
Total Hours		24

Textbook :

- 1 Designing with the mind in mind: simple guide to understanding user interface design guidelines., Johnson, Jeff, Morgan Kaufmann, 2020

References:

- 1 Human Computer Interaction, Human Computer Interaction, Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Prentice Hall, 2004
- 2 User interface design and evaluation, User interface design and evaluation, Stone, Debbie, et al, Elsevier, 2005
- 3 The design of everyday life, The design of everyday life, Shove, Elizabeth, Berg, 2007

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
15.00	20.00	25.00	20.00	15.00	5.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Instructional Method:

- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

- 1 <https://nptel.ac.in/courses/106/103/106103115/>
- 2 https://nptel.ac.in/content/syllabus_pdf/106103115.pdf
- 3 <http://codex.cs.yale.edu/avi/os-book/OS9/slide-dir>
- 4 <https://HMI-iitg.vlabs.ac.in/>