

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	BTech CSE, Integrated BTech (CSE)-MBA, BTech CSE (Artificial Intelligence & Machine Learning)
Course Code:	XXXX
Course Title:	Human-Computer Interface
Course Type:	Department Elective-II
Year of Introduction:	2025-26

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Course Learning Outcomes (CLO):

At the end of the course, the students will be able to -

1. apply an appropriate interaction style for implementing interaction between human and computer (BL3)
2. implement the HCI techniques to design multimodal UI (BL3)
3. evaluate user interfaces to detect usability problems (BL5)
4. build multimodal applications based on sensory signal-driven UI. (BL6)

Unit	Contents	Teaching Hours (Total 45)
Unit-I	Introduction: Introduction to the field of HCI, human factors engineering, and user experience design. Human perception: perception, gestalt perception, information presentation: typography, color, graphic design, displays, paper, and other output devices, layout: forms design and information visualization.	05
Unit-II	Interactive Devices and User Interfaces: Input devices and ergonomics: augmented reality, virtual reality, multi-touch, haptics, wearables, brain-computer interfaces, eye tracking, and tangibles. Multimodal user interfaces and context-sensitive interfaces, basic technologies for handling speech, vision, thought, pen-based interaction, and other modalities, and various techniques for combining modalities.	12
Unit-III	Interaction styles: metaphor, direct manipulation, widget survey, other interaction styles, and choosing among interaction styles	06
Unit-IV	User Interface Design and Principles: principles of HCI, the ubiquity of feedback cycles, the importance of direct manipulation, and the extent of human abilities as they relate to computer interfaces, understanding of user tasks and activities, HCI heuristics. Creating good user interfaces: need-finding, prototyping potential interfaces,	07

and evaluating those interfaces with users, research ethics underlying the design life cycle, as well as applications of this life cycle to the modern era of rapid prototyping, Strategies for efficient and intelligent user interfaces, Design and development of applications using human-computer interaction

Unit-V	Human-computer interaction using artificial intelligence: Introduction to artificial intelligence and current trends, human-centered artificial intelligence, uses of artificial intelligence with human-computer interaction in psychology, managing post-pandemic effects using artificial intelligence with human-computer interaction	10
Unit-VI	Case Studies: Exploration into the applications of HCI to open areas like augmented reality, education, social computing, mental health, healthcare, medical science, and assistive applications for differently abled	05

Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study contents

Suggested Readings/ References:

1. Ben Shneiderman, Catherine Plaisant, et al. Designing the User Interface, Addison Wesley
2. Surbhi Bhatia Khan, Suyel Namasudra, Fatos Xhafa. Innovations in Artificial Intelligence and Human-Computer Interaction in the Digital Era, Academic Press
3. Yang Li, Otmar Hilliges. Artificial Intelligence for Human-Computer Interaction: A Modern Approach, Springer
4. Stanley Harmon et al. Human-Computer Interaction: Emerging Trends, Murphy & Moore Publishing
5. Preece, Sharp & Rogers, Interaction Design: Beyond Human-Computer Interaction, John Wiley & Sons
6. Dix A., Finlay J., Abowd G. D. and Beale R., Human-Computer Interaction, Pearson Education.
7. Orestis Georgiou, William Frier, Euan Freeman et al. Ultrasound Mid-Air Haptics for Touchless Interfaces (Human-Computer Interaction Series), Springer.
8. Benjamin Weyers, Judy Bowen, Alan Dix, Philippe Palanque. The Handbook of Formal Methods in Human-Computer Interaction (Human-Computer Interaction Series), Springer
9. Jean Vanderdonckt. Handbook of Human-Computer Interaction (Springer Handbooks)
10. Cooper, Reimann, Cronin, & Noessel., About Face: The Essentials of Interaction Design, Wiley
11. Preece J., Rogers Y., Sharp H., Baniyon D., Holland S., and Carey T., Human-Computer Interaction, Addison-Wesley.
12. B.Shneiderman, Designing the User Interface, Addison-Wesley (Indian Reprint)

Laboratory Work:

Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated. The students in a suitable group size will design and perform one experiment as a part of Laboratory work.

Sr No	List of Experiments/Exercises	Hours
1	To design a voice-controlled robot. Build the robot chatbot using cloud services such as conversation service, Text-to-speech conversion, language translator, and speech-to-text conversion services. The application can be built on IBM/Google/any other cloud platform, and the application needs to be deployed on Arduino/Raspberry Pi.	02
2	To design a voice-controlled application using Alexa skills and install the skill on an Alexa device.	04
3	To design an application that senses vibrotactile feedback/action using haptics technology and behaves accordingly.	02
4	To design an application that senses the tactile perception using any one type of mechanoreceptors: Merkel disks, Ruffini cylinders, Pacinian corpuscles, Meissener's corpuscles, and based on the perception, different functions are executed.	04
5	To design an application that detects bodily position, weight, or movement of the muscles, tendons, and joints using various sensors (kinesthetic haptics) and uses that information to build a customized application	04
6	To study the workings of the brain interface device (Emotiv EPOC+/any other EEG device) and learn to configure and calibrate it for experiment use.	02
7	To record brain signals for users using Emotiv EPOC+ when they perform a specific task (e.g., reading a passage) and to analyze the recording using Emotiv Pro / similar software.	04
8	To study the workings of the Eye Tracker device and learn how to configure and calibrate it for experiment use.	02
9	To analyze the eye responses for interpreting/predicting the perception of a user for the viewed/read content from the user screen/ visual field.	04
10	To use various wearable devices and/or sensory input devices to record various sensory signals and use the signals to build a novel application.	02