**DEPARTMENT OF INFORMATION TECHNOLOGY, NITK SURATHKAL**

**Course Plan for IT351: Human Computer Interaction (3-0-2)4 (January - May 2023)(Even Semester)**

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| **Faculty in-charge** | **Ms Meghana Pujar** | **Year and Semester** | **Third Year B.Tech (IT) (Sixth Semester)** |
| **Course Code:** | **IT351** | **Course Name:** | **Human Computer Interaction** |
| **Core/Elective/MLC:** | **Core** | **L-T-P:** | **(3-0-2): 4** |
| **Pre-requisites:** |  | **Contact Hours:** | **3 Theory Classes per Week,**  **2 Laboratory Classes per Week** |
| **Type of Course:**  **(Lecture/Tutorial/Seminar/Project)** | **Lecture** | **Grading Scheme:** | **Mid Semester Examination - 20%**  **End Semester Examination - 40%**  **Weekly Lab Assignments - 20%**  (*Lab assessments: Design and Implementation: 10%, Project Demo/Report: 10% )*  **Mini/Minor Course Project - 20%**  (*Design and Implementation: 10%; Results, Analysis and Discussion: 5%;*  *Project Demo/Report: 5%* |
| **Course Description:** HCI is a multi- and interdisciplinary field involving inputs from computer science, behavioral sciences and design sciences. It studies the interactions between a human and computer. Interactions between humans and computers happen through interfaces on devices be they physical or virtual. HCI involves hardware and software. The design of physical input devices such as keyboards, mouse, joystick, touch screen, etc as well as graphics on screens are of interest. The definition given by the Association of Computing Machinery – ACM states that HCI is "a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them".  Usability Engineering is concerned with HCI and specifically with conceptualizing, designing, constructing and prototyping interfaces as in software and as in hardware (products). Achieving highest possible user satisfaction in the use of the product is the prime aim. Human beings and their limitations both cognitive as well as physical are researched and engineered into the designs. Graphical user interface, gestural and sound interfaces; vision and perceptual interfaces, brain and thought operated interactions are some of the areas on which usability engineers work upon. Usability engineering inputs come from cognitive sciences and engineering sciences as well as computer sciences. Usability engineers are both creative designers as well as engineers building products. Usability Engineering is new and emerging area of specializations and incorporates in its fold sub areas in Creative Design such as an Interaction Design (ID), the User Experience Design (UXD), the User Centered Design (UCD), and the User Participatory Design (UPD).  The course covers Interaction with Computers: Vision, Graphic Design, and Visual Displays -Touch, Gesture and Marking, Speech, Language and Audition;HCI Design and Evaluation Principles; The Design Process of Developing Interactive Systems: Concepts of Usability, GUI Design and Aesthetics, Prototyping Techniques; Model Based Design and Evaluation: Formal (System) and Cognitive (User) Models, Descriptive and Predictive Models, Keystroke Level Model (KLM), CMN (GOMS) Model, Individual Models of Human Factors; HCI Guidelines: Shneiderman’s Eight Golden Rules, Norman’s Seven Principles, Norman’s Model of Interaction, Nielsen’s Ten Heuristics, Heuristic Evaluation, Contextual Inquiry, Cognitive Walkthrough; Empirical Research Methods in HCI: Analysis of Empirical Data, ANOVA Test; Task Modeling and Analysis: Hierarchical Task Analysis (HTA), Engineering Task Models; Dialog Design; Cognitive Architecture: Model Human Processor; Design Case Studies involving the User-Centered Design and User Participatory Design and Evaluation; HCI Tools for Audio, Visual, Animation and IoT based Smart Interactive Systems; Ubiquitous Computing, Augmented /Virtual /Mixed Realities and Applications.  **Course Educational Objectives (CEO):**  1. To Provide the Students for the Basic Understanding of the Different Ways to Design and Evaluation Methods of "Good/User-Friendly Interfaces and Interactive Systems"   * Concepts and Fundamentals of HCI, Different Kinds of Interaction Scenarios, the User-Centered Design and the User Participatory Design Process. * Design and Evaluation of HCI Systems using Different Models (Cognitive, System and Task) and thus Reducing the Design Time, Effort in Building the Application * Guidelines and Heuristics for Interactive System Design and Analysis of Empirical Data for Taking Design Decisions.   2. To Provide the Students for the Understanding of the Design Techniques and Tools for Building HCI Systems with respect to Effective Interfaces and Affective User Experiences.   * Design Techniques for Different HCI Systems. * Techniques and Tools for Implementing the HCI Applications. * Design an Effective Interface while considering the Users' Experience. * Describe How a User’s Affective (Emotional) Reaction to an Interface   3. To Provide the Students the Working Principles of HCI Tools like Google Glass, Kinect, Myo, Leap Motion, Oculus Rift, Sense 3D, Guile 3D Studio, Arduino, Environmental and  IoT Sensors for the Design and Implementation of HCI Applications.   * Tools for Speech, Image, Video, Animations and other Arduino Based Environmental Sensors * Application Case Studies using HCI Tools: Smart Systems for Building / Campus / Class / City / Home/Factory, Health Care, Learning Environments, Sports & Games etc.   4. To Provide the Students for Basic Understanding of Ubiquitous Computing, Augmented / Virtual / Mixed Realities and Applications.  5. To Provide the Students for Basic Understanding of the Human Psychology and Context-Aware Processing.   * Study of Human Cognition Nature and Status of Mind. * Building Intelligent HCI Systems for Different Kinds of People. * Study of Behavior, Cyber Sickness, Emotional, and Stress Syndrome based on the Text, Audio, Image, and Video with respect to HCI Systems   6. To Provide the Students for Basic Understanding of the Challenging Issues, Research Trends in HCI Systems (UI, UCD, UXD).  **Course Outcomes (COs):**  CO1: Design and Development of HCI Systems using Interactive User Interfaces, User-Centered/User Participatory Design, Design Rules, Implementation, Evaluation Techniques,  Universal Design, User Support including the Effective User Interfaces and Affective User Experiences.  CO2: Design and Development of HCI Systems using Tools like Google Glass, Kinect, Oculus Rift, Myo, Leap Motion, Sense 3D, Guile 3D, Face-Shift, Arduino etc.  CO3: Design and Development of HCI Systems using the Basic Concepts of Ubiquitous Computing, Augmented Reality, Virtual Reality & Mixed Reality and its Applications.  CO4: Understanding/Recognizing Ethical Issues like Copyright Infringement while Developing HCI Systems using Principles of Human Psychology and Context-aware Processing.  **Assessment COs Matrix:**   |  | | --- | | **Assessment Type** | | **Course Outcomes (COs)** | | | | | **CO1** | **CO2** | **CO3** | **CO4** | | Mid Semester Examination |  |  |  |  | | **End Semester Examination** |  |  |  |  | | Weekly Lab Assignments |  |  |  |  | | **Course Project (Mini/Minor)** |  |  |  |  |   **Course Plan:**   * Week 1, 2: Introduction to Human Computer Interaction, Usability Engineering, User-Centered Design, Effective Interfaces and Affective User Experience Design.   Interactive System Design: Concept of Usability, User-Centered & Participatory Design, Interactive System Design Life Cycle, GUI Design & Aesthetics, Prototyping.   * Week 3, 4, 5: Model-Based Design and Evaluation; Different Models for Designing HCI Systems: Prescriptive Model and Predictive Model, GOMS Family of Models - Keystroke Level Model (KLM), CMN (GOMS) Model, Individual Models of Human Factors, Case-Studies on Model Based Design. * Week 6, 7, 8, 9: HCI Guidelines, Heuristic Evaluation, Empirical Research Methods & Data Analysis, Task Modeling & Analysis, Dialog Design, Cognitive Architecture;   HCI Guidelines: Shneiderman’s Eight Golden Rules, Norman’s Seven Principles, Norman’s Model of Interaction, Nielsen’s Ten Heuristics, Heuristic Evaluation, Contextual Inquiry, Cognitive Walkthrough, Empirical Research Methods in HCI: Statistical Analysis of Empirical Data, ANOVA Test; Task Modeling and Analysis: Hierarchical Task Analysis (HTA), Engineering Task Models; Dialog Design; Cognitive Architecture: Model Human Processor; Design Case Studies.   * ***Week 10, 11:*** HCI Systems for Kids, HCI Systems for Visually Impaired (Blind Users), Hearing Impaired (Deaf and Hard of Hearing Users), Speech Impaired (Dumb Users). * ***Week 12, 13, 14:*** HCI Tools like Google Glass, Kinect, Oculus Rift, Myo, Leap Motion, Sense 3D, Guile 3D Studio, Face-Shift for Augmented, Virtual & Mixed Realities, Human Activity Recognition and Smart Application Environments: Smart Building, Smart Class, Smart Campus, Smart City, Smart Home, Smart Factory (Industry 4.0); Ubiquitous Computing, Context-Aware and Healthcare Applications.   **Recommended References:**   1. Samit Bhattacharya, "Human-Computer Interaction: User Centric Computing for Design", McGraw Hill Education (India) Pvt. Ltd, First Edition, 2019. 2. Jenny Preece, Helen Sharp, Yvonne Rogers- Interaction Design: Beyond Human Computer Interaction, John Wiley and Sons Ltd, Fifth Edition, 2019. 3. Bowman, Doug A.; Kruijff, Ernst; LaViola Jr., Joseph J.; Poupyrev, Ivan, "3D User Interfaces: Theory/Practice", Addison-Wesley, 2nd Edition, 2017. 4. I. Scott MacKenzie, "Human-Computer Interaction: An Empirical Research Perspective", Morgan Kaufmann, 1st Edition, 2013. 5. Alan Dix, Janet Finlay, Gregory Abowd and Russell Beale, Human Computer Interaction, Pearson Education and Prentice Hall, Third Edition, 2004. 6. Philip Kortum, HCI beyond the GUI: Design for Haptic, Speech, Olfactory and Other Nontraditional Interfaces, Morgan Kaufmann/Elsevier, 2008. 7. Ben Shneiderman, Catherine Plaisant, Designing the User Interface: Strategies for Effective HCI, 5th Edition, Pearson Education, 2009. 8. IEEE, ACM, Elsevier, Springer Conference and Journals Papers on HCI, Affective/Effective UXD and Augmented/Virtual/Mixed Realities. 9. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-831-user-interface-design-and-implementation-spring-2011/index.htm> 10. <https://ocw.mit.edu/courses/media-arts-and-sciences/mas-630-affective-computing-fall-2015/index.htm> 11. <https://www.coursera.org/courses?query=human%20computer%20interaction> 12. NPTEL Course on User Centric Computing for HCI, IIT Guwahati (<https://nptel.ac.in/courses/106/103/106103220/>) 13. NPTEL Course on HCI, IIT Guwahati (<https://nptel.ac.in/courses/106/103/106103115/>) 14. NPTEL Course on HCI, IIIT Delhi (<https://nptel.ac.in/courses/106/106/106106177/>) 15. Shakshat Virtual Lab on HCI, IIT Guwahati (<https://hci-iitg.vlabs.ac.in/>) 16. Embedded Interaction Lab, IIT Guwahati (https://www.embeddedinteractions.com/) 17. Virtual Human Interaction Lab, Stanford University (<https://vhil.stanford.edu/>)   ***Detailed Course Objectives and Outcomes:***   |  |  |  |  | | --- | --- | --- | --- | | ***Strategic Objective*** | ***Course Outcome*** | ***Course Activity*** | ***Course Assessment*** | | Knowledge | ***CO1:*** Understand the Importance of Sound Theoretical Knowledge in HCI w.r.t. User-Centric Computing Design. | Present Examples  Involving Real World Applications of HCI. | Make Students to Implement the  Real Life Applications of HCI. | | Learning | ***CO2:*** Understand the Principles of Interactive Design, User Centre Design Rules, Implementation Support, Evaluation Techniques, Universal Design and User Support w.r.t. Effective Interfaces and Affective User Experiences. | Explain the Important Concepts and Designs. | Make Students to Learn the  HCI Designs by Case-Studies. | | Problem Solving | ***CO3*:** Understand the Working Principles of HCI Systems and HCI Tools like Google Glass, Kinect, Oculus Rift, Myo, Leap Motion, Sense 3D, Guile 3D Studio, Face-Shift etc. for Solving the Real-life Problems and Application Areas. | Discuss / Analyze  Various Generic and  Specific Application Environments. | Make students present such extensions and special cases as part of HCI laboratory assignments. | | Teamwork | ***CO3:*** Understand the Basics of HCI (UID, UCD, UXD), Ubiquitous Computing, Augmented / Virtual / Mixed Reality. | Encourage Students  towards Team Projects. | Form Teams of Students and Ask  them to Present/Demo their Projects. | | Ethics | ***CO4*:** Recognize the Ethical Issues such as Copyright Infringement while Developing Systems using HCI Design/ Evaluation Principles and Understand the Fundamentals of Human Psychology and Context-aware Processing. | Educate Students the Importance of Academic Integrity and Ethics | Enforcement of Strict Rules & Code of Conduct and Avoid Breaches | | | | |
| **Course Mentor : TAs:**  Prof. Ram Mohana Reddy Guddeti Mrs Madhusmita Das, Rahul Kumar, Mrs Sona Mundody, Harshit Chopra,  Nidhi Ekka, Vivek Kumar, Sarvesh Joshi, Sandeep Chouhan, Ankit Kumar | | | |