



# Course File

## Human Computer Interaction

Dr Paras Kothari

Academic  
Session

2021

<https://www.technonjr.org/>

For Techno India NJR Institute of Technology  
पंकज पौरवाल  
Dr. Pankaj Kumar Perwal  
(Principal)

## Theory Session



RAJASTHAN TECHNICAL UNIVERSITY, KOTA

**Teaching & Examination Scheme**  
**B.Tech. : Computer Science & Engineering**  
**3<sup>rd</sup> Year – V Semester**

THEORY											
SN	Category	Course		Contact hrs/week			Marks				Cr
		Code	Title	L	T	P	Exam Hrs	IA	ETE	Total	
1	ESC	5CS3-01	Information Theory & Coding	2	0	0	2	20	80	100	2
2	PCC/PEC	5CS4-02	Compiler Design	3	0	0	3	30	120	150	3
3		5CS4-03	Operating System	3	0	0	3	30	120	150	3
4		5CS4-04	Computer Graphics & Multimedia	3	0	0	3	30	120	150	3
6		5CS4-05	Analysis of Algorithms	3	0	0	3	30	120	150	3
7		Professional Elective 1: (any one)		2	0	0	2	20	80	100	2
		5CS5-11	Wireless Communication								
	5CS5-12	Human-Computer Interaction									
	5CS5-13	Bioinformatics									
		<b>Sub Total</b>		<b>16</b>	<b>0</b>	<b>0</b>		<b>160</b>	<b>640</b>	<b>800</b>	<b>16</b>

**Note: L: Lecture; T: Tutorial; Cr: Credits; ETE: End Term Exam; IA: Internal Assessment**

### Course Overview

In this course, students are introduced to the fundamental theories and concepts of human computer interaction (HCI). HCI is an interdisciplinary field that integrates theories and methodologies across many domains including cognitive psychology, neurocognitive engineering, computer science, human factors, and engineering design. Students will gain theoretical knowledge of and practical experience in the fundamental aspects of human perception, cognition, and learning as relates to the design, implementation, and evaluation of interfaces.

Topics covered include: interface design, usability evaluation, universal design, different modes of interfaces (touch, vision, natural language and 3-D audio), virtual reality, and spatial displays.

In addition to lectures, students will work on individual and team assignments to design, implement, and evaluate various interactive systems and user interfaces based on knowledge picked from class material and additional research.

### Objectives

- To learn the basic physiological, perceptual, and cognitive components of human learning and memory.
- To gain theoretical knowledge of and practical experience in the fundamental aspects of designing and implementing user interfaces.
- To analyze interaction problems from a technical, cognitive, and functional perspective.
- To develop an awareness of the range of general human-computer interaction issues that must be considered when designing information systems.
- To learn about multimodal displays for conveying and presenting information.

### Consequences (Outcomes)

Upon completion of the course, students would be able to:

- Explain the capabilities of both humans and computers from the viewpoint of human information processing.
- Describe typical human-computer interaction (HCI) models and styles, as well as various historic HCI paradigms.
- Apply an interactive design process and universal design principles to designing HCI systems.
- Describe and use HCI design principles, standards and guidelines.
- Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.
- Discuss tasks and dialogs of relevant HCI systems based on task analysis and dialog design.
- Analyze and discuss HCI issues in groupware, ubiquitous computing, virtual reality, multimedia, and Word Wide Web-related environments.

**Course Outcomes:**

5CS512	Cognitive Level	Human-Computer Interaction Year of study: 2020
CO3512.1	Comprehension	Student will be able to list the capabilities of both humans and computers from the viewpoint of human information processing.
CO3512.2	Comprehension	Student will be able to describe typical human-computer interaction (HCI) models and styles, as well as various historic HCI paradigms.
CO3512.2	Application	Students will be able to apply an interactive design process and universal design principles to designing HCI systems.
CO3512.3	Analysis	Students will analyze and identify user models & support, socio-organizational issues, and stakeholder requirements of HCIs.
CO3512.3	Comprehension	Students will be able to discuss tasks and dialogs of relevant HCI systems based on task analysis and dialog design.

Human-Computer Interaction Year of study: 2020-21															
Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO35511.1	3	1	0	1	0	0	0	0	0	0	0	1	2	1	1
CO35511.2	2	2	0	1	0	0	0	0	0	0	0	1	2	1	1
CO35511.3	3	2	3	1	0	0	0	1	1	0	1	1	2	1	1
CO35511.4	2	2	1	3	1	0	0	0	1	2	2	1	2	1	1
CO35511.5	1	3	3	2	1	0	0	0	0	0	2	1	2	1	1

**Note:** Relationship Matrix between Objectives and Outcome need to be furnished during course implementation period.

**Prerequisites**

- Significant experience using computers and GUI-based applications, and ability to create simple web pages.
- Demonstrable programming skill in at least one high-level language.
- Aware with design engineering concepts and implementation
- Thoughtfulness of problem solving techniques in OO environment

## Course Syllabus: Human Computer Interaction

### Theory Classes



RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year-V Semester: B.Tech. Computer Science and Engineering

### 5CS5-12: Human Computer Interaction

Credit: 2  
2L+0T+0P

Max. Marks: 100(IA:20, ETE:80)

End Term Exam: 2 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	01
2	Historical evolution of the field, Interactive system design, Concept of usability -definition and elaboration, HCI and software Engineering, GUI design and Aesthetics, Prototyping techniques.	02
2	<b>Model-based Design and evaluation:</b> Basic idea, introduction to different types of models, GOMS family of models (KLM and CMN-GOMS), Fitts' law and Hick-Hyman's law, Model-based design case studies,	03
3	<b>Guidelines in HCI:</b> Shneiderman's eight, golden rules, Norman's seven principles, Norman's model of interaction, Nielsen's ten heuristics with example of its use Heuristic evaluation, Contextual inquiry, Cognitive walkthrough	05
4	<b>Empirical research methods in HCI:</b> Introduction (motivation, issues, research question formulation techniques), Experiment design and data analysis (with explanation of one-way ANOVA)	06
5	<b>Task modelling and analysis:</b> Hierarchical task analysis (HTA), Engineering task models and Concur Task Tree (CTT), introduction to formalism in dialog design, design using FSM (finite state machines) State charts and (classical) Petri Nets in dialog design	06
6	<b>Introduction to CA,</b> CA types, relevance of CA in IS design Model Human Processor (MHP), OOP- Introduction OOM- Object Oriented Modeling of User Interface Design	05
	<b>Total</b>	<b>28</b>

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## Lecture Plan: (40 Hours)

Lecture #	Unit Based Mapping	Lecture Title
1	1	<b>Subject Introduction</b>
2		Objective, scope and outcome of the course.
3		Historical evolution of the field, Interactive system
4		Concept of usability -definition and elaboration
5		HCI and software Engineering
6		GUI design and Aesthetics, Prototyping techniques
7	2	<b>Model-based Design and evaluation</b>
8-9		Basic idea and introduction to different types of models
10-11		GOMS family of models (KLM and CMNGOMS)
12		Fitts' law and Hick-Hyman's law
13-14		Model-based design case studies
15	3	<b>Guidelines in HCI</b>
16		Shneiderman's eight, golden rules
17		Norman's seven principles
18		Norman's model of interaction
19-20		Nielsen's ten heuristics with example of its use Heuristic evaluation
21		Contextual inquiry, Cognitive walkthrough
22	4	<b>Empirical research methods in HCI</b>
23		Introduction( motivation, issues)
24		Research question formulation techniques
25-26		Experiment design and data analysis
27		one-way ANOVA
28	5	<b>Task modeling and analysis</b>
29		Hierarchical task analysis (HTA)
30		Engineering task models and Concur Task Tree (CTT)
31		Introduction to formalism in dialog design
32		Design using FSM (finite state machines) State charts
33		Petri Nets in dialog design
34-35	6	<b>Introduction to CA</b> CA types, relevance of CA in IS design Model
36		Human Processor (MHP),
37		OOP- Introduction OOM
38		Object Oriented Modeling of User Interface Design
39-40	ALL	

## Learning Resources

### Text Books/Reference Books

- Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —Human Computer Interaction, 3rd Edition, Pearson Education. ISBN: 9780130461094
- Andrew Sears – Human Computer Interaction , CRC Press ISBN: 1410615863
- Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. Human Computer Interaction, Addison-Wesley, 1994. ISBN: 0201627698
- Cooper, Reimann, Cronin, & Noessel., About Face: The Essentials of Interaction Design, Wiley. ISBN: 1118766571

### Online References

- **Notes** by [www.tutorialspoint.com](http://www.tutorialspoint.com)  
[https://www.tutorialspoint.com/human\\_computer\\_interface/index.htm](https://www.tutorialspoint.com/human_computer_interface/index.htm)
- **Article** on [www.geeksforgeeks.com](http://www.geeksforgeeks.com)  
<https://www.geeksforgeeks.org/human-computer-interaction-through-the-ages/>
- NPTEL **Videos**  
<https://nptel.ac.in/courses/106/103/106103115/>

### Teaching Resources

- Presentations, during classroom discussion, will be available on Google in PDF format
- Various online and offline resources will be shared during course compilation

### Assessment

#### Internal

- Online Quiz during course compilation with tools like Kahoot, Google forms etc.
- Assignment Submission through Google Classroom after every Unit of Syllabus.
- Case studies and Problem Scenario discussion after every topic
- Presentation and Report on Final Assignment

#### External

- As per Rajasthan Technical University – Kota's guidelines
- Previous Years Question Papers are available on [www.rtu.ac.in](http://www.rtu.ac.in) or Examination Cell of [www.technonjr.org](http://www.technonjr.org)

**Assignment – I**

1. Discuss the advantages and disadvantages of Graphical system CO1
2. Describe contemporary input methods and devices. CO1
3. What is Ergonomics? How human factor engineering effects design. CO2
4. Discuss various interaction styles CO2
5. Explain Donald Norman's model of users' view on interface CO3

**Assignment – II**

1. Express General principles go Graphic Design. (Any 7) CO1
2. What are the common categories of Human –Computer Interaction? CO2
3. How good design make user interface friendly? Define with Example. CO2
4. Elucidate the Execution and Evaluation loops with respect to DN Model CO3
5. What is Ethnographic Research Method (ERM)? Define Contextual Inquiry in reference of ERM. CO3

**Assignment – III**

1. Discuss any 5 heuristics given by Nielsen for design usability guidelines. CO3
2. Discuss the research question formulation techniques with example. CO4
3. How Concur Task Tree (CTT) can be used to define engineering model CO4
4. Explain the Visual Thinking on following points  
a. Visual Immediacy  
b. Visual Impedance CO5
5. Elucidate Form fill-in design guidelines and dialog boxes. CO5

**Assignment – IV**

1. Differentiate between Cognitive Walkthrough, Heuristic Evaluation and usability Testing CO3
2. What is Ethnographic Research Method (ERM)? Define Contextual Inquiry in reference of ERM. CO3
3. Discuss various observational methods along with their advantages and disadvantages. CO4
4. What are Menu Layout principles and how they effect on menu design. CO5
5. Write a note on State Transition Diagram with STD components and suitable example. CO5



## Viva Voice Questions

### Unit -1: HCI Introduction

1. What Is Meant by Human Computer Interaction?
2. How Does the User Interact with The Computer?
3. Why HCI Is Important?
4. What Is Design in HCI?
5. What Is Human Social Interaction?

### Unit -2: Model Based Design and evaluation

1. What is a mental operator in the Keystroke Level Model (KLM)? How it is different from physical operators?
2. Discuss the key differences between KLM and (CMN)GOMS.
3. What is throughput? How it can be used in the design of interactive systems?
4. Discuss how the Fitts' law can be used to predict performance.
5. Explain the Hick-Hyman law. Describe the predictive formulation of the law

### Unit -3: Guidelines in HCI

1. What are the Guidelines in HCI?
2. What are 8 golden rules?
3. How Norman's 7 principles effect interaction?
4. What are 10 heuristics principles?
5. What is Cognitive Walkthrough?

### Unit 4 – Empirical Research Methods in HCI

1. What is information gathering tools?
2. How questionnaire helps in research?
3. What should be the questionnaire design technique for HCI research?
4. What is ANOVA?
5. What is the role of tests in data analysis?

### Unit 5 – Task Modeling and Analysis

1. What is Hierarchical Task Analysis?
2. What is the role of Finite State Machine in design?
3. What is Dialog box? Define the role of DB in design?
4. What is state chart? How it effects dialog design?
5. What is Conquer Task Tree (CTT)?

Question Paper

May - 2018

<b>6E6028</b>	Roll No. _____	rtuonline.com	Total No. of Pages : <b>3</b>
	<b>6E6028</b>		
<p><b>B. Tech. (Sem. VI) (Main &amp; Back) Examination, April-May 2018</b>  <b>Computer Sc. &amp; Engg.</b>  <b>6CS6.3A Human Computer Interface</b>  <b>CS, IT</b></p>			

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 26

*Attempt any five questions, selecting one question from each unit.  
 All Questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.*

*Use of following supporting material is permitted during examination.  
 (Mentioned in form No. 205)*

1. NIL2. NIL

## UNIT - I

1 (a) Describe various positioning, pointing and drawing devices.

8

(b) Explain following :

- (i) Deductive reasoning
- (ii) Inductive reasoning
- (iii) Gestalt theory
- (iv) Problem space theory

4×2=8

OR

1 (a) Explain following :

- (i) The execution - evaluation cycle
- (ii) The interaction framework

2×4=8

- (b) Discuss the paradigms for interaction.

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8

### UNIT - II

- 2 (a) What is design ? Explain navigation design.

8

- (b) What is usability engineering ? Discuss the problems with usability engineering.

8

OR

- 2 (a) Describe the principles affecting flexibility and robustness.

8

- (b) Describe Shneiderman's eight golden rules of interface design.

8

### UNIT - III

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- 3 (a) What is evaluation ? Discuss the factors that should be taken into account when selecting evaluation techniques.

8

- (b) Discuss different approaches to evaluation through user participation.

8

OR

- 3 (a) Describe adaptive help systems.

8

- (b) How the user support system is presented to the user and this will be affected by implementation issues ? Explain.

8

**UNIT - IV**  
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- 4 (a) Explain GOMS and CCT models. 8
- (b) Compare and explain BNF and TAG. 8

**OR**

- 4 Explain following :
- (a) Keystroke-level model
- (b) Three-state model
- (c) The problem space model
- (d) Interacting cognitive subsystems.

4×4=16

**UNIT - V**

- 5 Explain following : (any two)
- (a) Face-to-Face Communication
- (b) Conversation
- (c) Text-based communication.

2×8=16

**OR**

- 5 (a) What is task analysis ? Describe the uses of task analysis. 8
- (b) Describe the sources of information and data collection. 8

## Quiz Questions

1. What does HCI stand for?
  - a. Human Computer Interface
  - b. Human Computer Interaction
  - c. Human Computer Implementation
  - d. Human Computer Industry
2. Which one of these would NOT be found in a good HCI?
  - a. Common short cuts, like CTRL+Z for undo.
  - b. Icons that can have specific meanings.
  - c. A long command line to achieve a function.
  - d. Sounds that convey meanings.
3. Which one of these is a good reason for taking care to design a good computer-human interface?
  - a. Not every user is computer expert
  - b. Well designed HCIs allow the software to be sold at a better price
  - c. Well-designed HCIs use less computer resources
  - d. Well-designed HCIs allow the computer to run faster
4. In virtual reality which of the senses cannot currently be portrayed?
  - a. Touch
  - b. Hearing
  - c. Sight
  - d. Smell
5. HCI is based on psychological factors of humans
  - a. True
  - b. False
6. Which of these is not an interface style
  - a. Command Line
  - b. Menus
  - c. Natural Languages
  - d. Voice Recognition
7. Which one of these is a good reason to include sounds in an HCI
  - a. Users react more quickly to sounds than to visual signals
  - b. Users react more slowly to sounds than to visual signals
  - c. There is no preference. People just like sounds
  - d. The computer reacts to sounds in the same way as a human
8. All countries read from left to right
  - a. True
  - b. False
9. A computer expert produces a solution with HCI which is very efficient in computer resources, based on command-lines. Which one of the following is most likely to be the result when the system is implemented?
  - a. It will be welcomed by all staff.
  - b. All staff will enjoy using it after mastering the skills of command lines.
  - c. Most staff will want to become computer experts to use it.
  - d. Most staff will feel demoralised and will not want to use the system.
10. Which of these films uses futuristic HCI
  - a. Speed
  - b. Minority Report
  - c. Terminator
  - d. Bambi