9. RAI- 835: Human-Robot Interaction

a. Textbook

- Christoph Bartneck, Tony Belpaeme, Friederike Eyssel, Takayuki Kanda, Merel Keijsers, Selma Sabanovic. Human-Robot Interaction- An Introduction (2020, Cambridge University Press)
- Designing Sociable Robots (Intelligent Robotics and Autonomous Agents series) by Cynthia Breazeal ISBN: 9780262025102.

b. Reference Books

- Human-Robot Interaction Evaluation Method and their standardization. Editor Nicole Miring
- Human Robot Interaction by Mansour Rahimi
- Human-Robot Interaction in Social Robotics by H. Ishiguro & T. Kanda
- Human-Robot Interactions: Principles, Technologies and Challenges. Editor: Diana Coleman.
- c. Pre-Requisite: Nil
- **d. Objective:** This is a highly research-oriented course with the basic objective of bringing the students face to face with the latest cutting edge research in the world. This will play a key role in helping them select suitable topics for their research that would lead to publications in leading international journals and conferences
- e. Course Outcome: Students completing this course are expected to have developed a firm knowledge base of critical understanding of the main theories, principles and concepts relating to the domain of Human-Robot Interaction.
- f. Course Outline: This course will cover a variety of topics related to social intelligence and socially intelligent robots. Readings/lectures will cover This course presents the fundamentals of a new area of research related to robotics called Human-Robot Interaction (HRI), which is based on the physical, cognitive, and social interaction between humans and robots. The HRI area focuses on understanding, designing, and evaluating the interaction between humans and robots that can communicate and/or share the physical space or workspace. The motivation for using HRI systems for an application where humans and robots can interact and cooperate is to reap the benefits of both worlds. For example, robots are great at performing repetitive and precise tasks, but they are not always useful for tasks that are complex or performed in unstructured environments. Humans, on the other hand, are excellent at complex manual tasks, have creativity, and excellent problem-solving skills, but tend to get tired or distracted easily. Among the main benefits of collaboration between humans and robots is to increase the productivity or efficiency of a process or a particular task, while reducing the workload of the human, and giving support to it in tasks that require it. The theoretical foundations of the course, as well as the applications and case studies presented, will serve as a basis for students and professionals to work or investigate various applications that

are not easy to fully automate, and that can benefit from interaction and cooperation between humans and robots.

• PART I: Introduction to Robotics

- Introduction to Robot Control
- Classification and types of Robot
- Psychological models for HRI

• PART II: Introduction to Human Robot Interaction (HRI)

- Insights from Developmental Psychology
- Human-Robot Interaction with examples oriented to the type of physical, cognitive and social interaction.
- Topics related to remote interaction, proximity interaction, teleoperation, and telemanipulation.
- Architecture for Social Interaction
- Case study for Architecture for Social Interaction
- Designing Sociable Robots and Social Interaction
- Architecture of Social Interaction
- The Vision System
- The Auditory System
- The Motivation System
- The Behavior System
- Facial Animation and Expression
- Expressive Vocalization System

• Part III: HRI System Design

- General concepts Interfaces and communication
- Productivity and profitability
- Safety with ISO and ANSI standards
- Metrics for HRI systems (type of metrics, mission effectiveness, human metrics, robot metrics)
- Neglect Tolerance
- Interaction Effort
- Robot Attention Demand (Free time, Fan out)
- Collaborative metrics
- Design concepts for HRI systems.
- Taxonomy for HRI systems
- Human factors in HRI systems
- HRI Application Case Study- Mobile Assistive Robot