1. **Course No:**

2. **Course Title:** Design for Human Machine Systemic Relationships

3. Per week Lectures: 3 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours [0-2]: 0 (A), Credits (3*L+2*T+P+A): 9  
   Duration of Course: **Full Semester**

4. **Proposing Department/IDP: Department of Design**  
   Other Departments/IDPs which may be interested in the proposed course: Computer Science, Medical School, Mechanical Engineering, Industrial Engineering and other associated departments involved in HMI research, human factors research or broader research with human interaction with technology.

   Other faculty members interested in teaching the proposed course: none

5. **Proposing Instructor(s):** Vivek Kant

6. **Course Description:**  
   The aim of the course is help students design interactions with technologies in systems. The course is envisioned as a course on design for postgraduate students. It will also support dual degree students in design as well as students from other departments. The course will addresses the design of human technology relationships in systems. The current course is primarily a design course which is builds on human-centered design theory, human factors engineering and systems thinking. It does not address the design of the underlying technology or computation or addresses technology and human culture (Other courses on HCI in computer science, Informatics or humanities and sociology will be a better fit). This course will, nevertheless, supplement these other technological courses in providing the students a holistic understanding of human technology relationships by developing the design dimension of human technology relationships. In this course, the students will learn the basics of a design process for advanced human machine interaction/human automation interaction. They will be exposed to existing tools, techniques as well as the theoretical basis of design. The course is an appropriate mix of lectures and studio practice. The students will complete certain assignments individually as well as work on a mini-project as a team. The focus will be to use these ideas to develop interfaces in application areas related to social innovation, defence, industry 4.0, healthcare, finance, energy, AI, safety and security, amongst other areas.

   a. **Course Objectives:**
At the end of this course, students will be able to,

- Understand and use the design process to design interfaces/interactions
- Use metrics and scales for evaluating interfaces/interactions
- Understand theory, methods and challenges associated with function allocation, situation awareness and other associated concepts in interaction design for complex systems

b. **Course Content:**

90 mins per session: 17 lecture sessions + 10 studio sessions

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<th>S.No.</th>
<th>Topic and Details</th>
<th>Sessions (Lectures &amp; Studio)</th>
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| 1     | **Foundations of Human-centered Interaction I**  
- Design and Cognition  
  - Embodied, Embedded, Extended and Enactive Cognition  
  - Activity Theory  
  - Distributed Cognition  
  - Elements of Operator experience | 1 |
| 2     | **Foundations of Human-centered Interaction II**  
- Human-centered Complexity  
- Human Technology relationships  
- Design for Human Behavior and Cognition in Complex systems  
  - HMI & HCI  
  - Designing for systemic roles | 1 |
| 3     | **Fundamentals of the Design Process**  
- Elements of the design process  
- High-performance HMI  
- Ecological Interface Design (EID)  
- EID vs. user-centered design  
- Design Theory for HMI  
- Digitalization and Human-Centered Design | 2 |
| 4     | Studio Practice 1: Problem formulation, Scoping based on Human-centered dimension of design | 1 |
| 5     | **Field Studies & Scenarios**  
- Interpretive basis of understanding  
- Creating a field study plan  
- Conducting a field study  
- Mapping Insights  
- Creating Scenarios | 2 |
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<th>6</th>
<th>Studio Practice 2: Scenario Creation and Validation</th>
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| 7 | Analysis techniques | - Cognitive Work Analysis  
- Functional Abstraction  
- Structural Decomposition  
- Activity Analysis  
- Cognitive Task Analysis  
- Hierarchical Task Analysis  
- Other analysis techniques | 3 |
| 8 | Studio Practice 3,4: Task/Work Analysis process practice | 2 |
| 9 | Functional Allocation | - Fitt’s function allocation techniques  
- Human in the loop  
- Human automation interaction  
- Manned and unmanned systems  
- Teleoperation | 2 |
| 10 | Studio Practice 5: Function Allocation based analysis for the project | 1 |
| 11 | Design for Situation Awareness | - Situation-awareness  
- Enemies of Situation Awareness  
(Fatigue, Data Overload, Salience...)  
- Situation-awareness oriented design  
- situation awareness and user-centered design | 2 |
| 12 | Studio Practice 6: Situation Awareness mapping and analysis | 1 |
| 13 | Synthesis Techniques I | - Developing Information architecture  
- Part-whole relationships  
- Part-whole hierarchies for developing information architecture  
- Card-sorting methods | 2 |
| 14 | Studio Practice 7: Information architecture design | 1 |
| 15 | Synthesis Techniques II | - Information Design  
- Navigation Design  
- Visual Design  
- Displays and controls  
- Visual ergonomics considerations | 1 |
### Physical ergonomics considerations

| 16 | Studio Practice 8,9: Prototype | 2 |
| 17 | **Evaluation of the interface/interaction**<br>- Verification and Validation<br>- Evaluation scales<br>- Systems Usability Scale<br>- Cognitive engineering heuristics | 1 |
| 18 | Studio Practice 10: Evaluation and user testing | 1 |

**Assignments** (studio + term paper presentation) 60% + final exam 40%

c. **Pre-requisites, if any**: None

d. **Short Summary**: The aim of the course is to help the students design interactive experiences in systems using a human-centered design approach.

e. **Recommended Books**:

**Text book**:

**References**:
• Journal Papers from the disciplines of Interface Design, Complex Systems, Sociotechnical systems and Human Machine Interaction

Dated: 8 May 2023

Proposers: Vivek Kant

Dated: DPGC Convener: