MSIE 4.0

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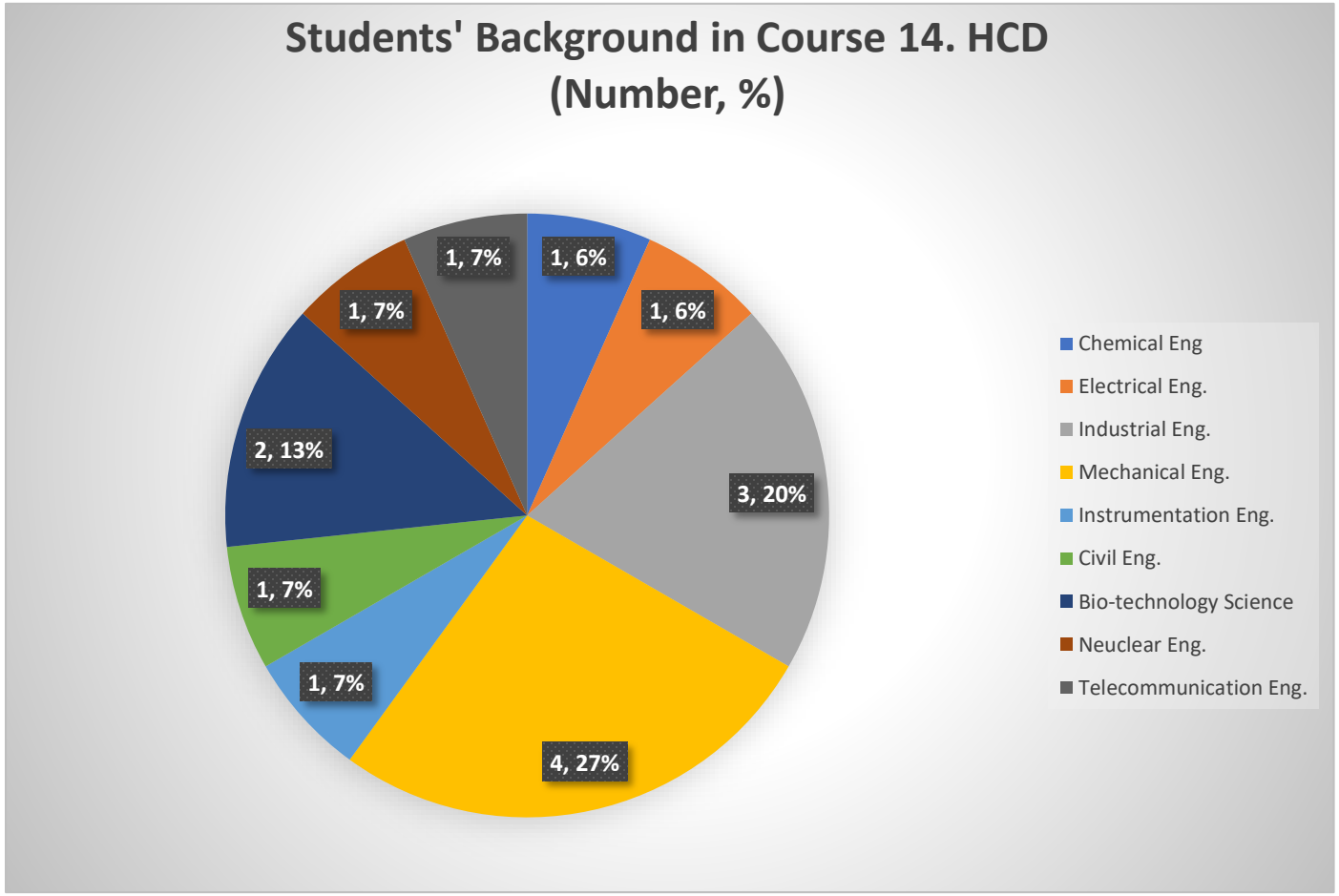
Course 14: Human Centric Design

Problem-Based Learning Course

Universidade do Minho

Curriculum Development
of Master's Degree Program in
Industrial Engineering for Thailand Sustainable Smart Industry

Students' Background
16 Students registered in Course 14 HCD



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Course Learning Outcome

Apply human abilities, limitations, needs and other important human characteristics for designing tasks, jobs, equipment, products, environments, processes and other element in working systems.

Evaluate occupational health and safety (OHS) risks to accidents, injuries, and ill health in a working system.

Create solutions and opportunities for reducing OHS risks, enhancing operators' performance and preference.

Design tasks, equipment, workstation, workspace, environment, and other elements in working systems compatible with needs, abilities and limitations of operators for better well-being and performance.

Analyze work organization affecting on human behavior and performance, e.g. policy, work schedule, motivation, satisfaction, communication and participatory.

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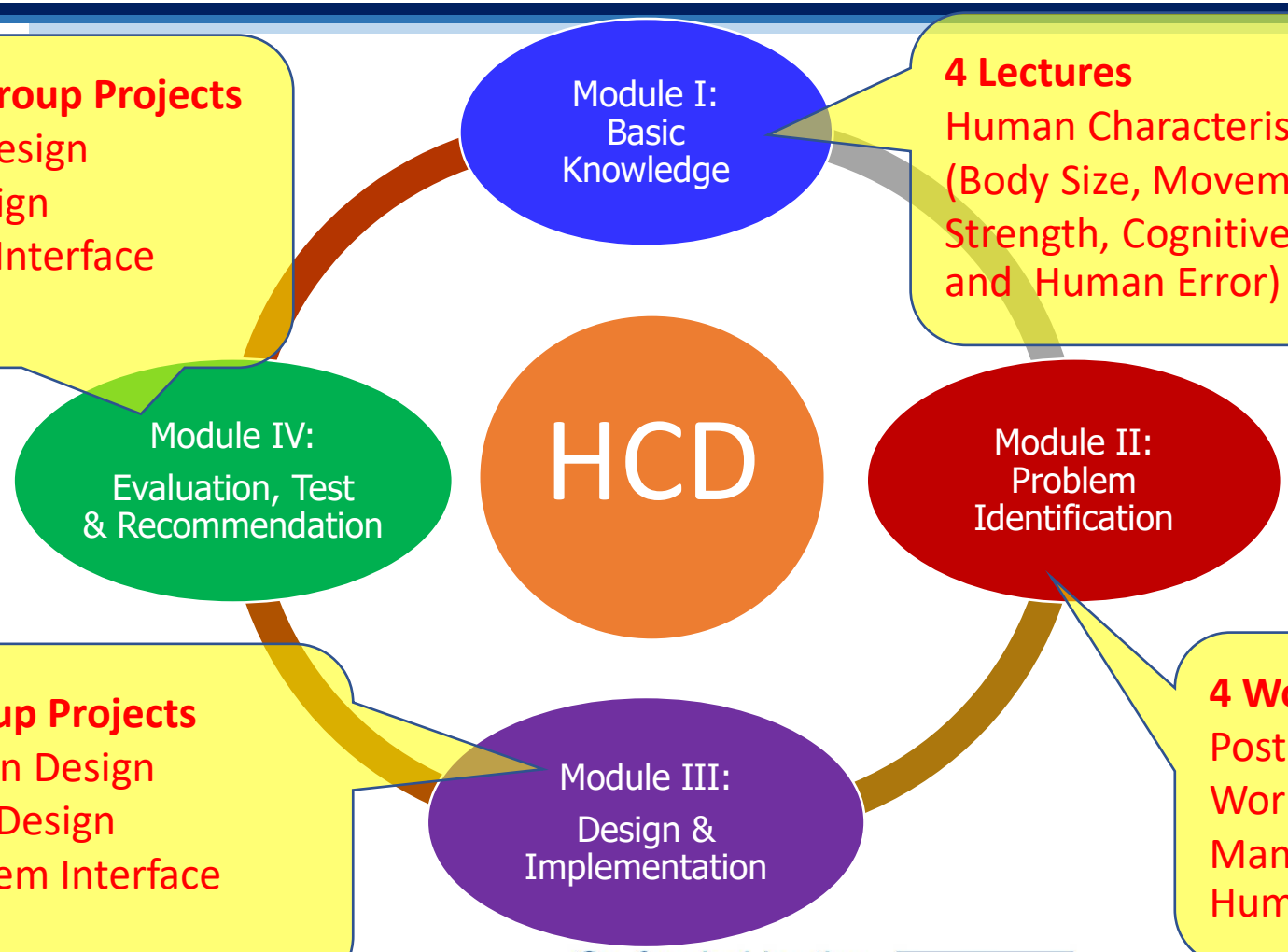
Structure of Course 14.

Presentation: 4 Group Projects
(1) Workstation Design
(2) Hand Tool Design
(3) Visual System Interface Design



4 Lectures
Human Characteristics
(Body Size, Movement, Strength, Cognitive, Decision and Human Error)

Design: 4 Group Projects
(1) Workstation Design
(2) Hand Tool Design
(3) Visual System Interface Design

4 Workshops
Posture & Movement
Workstation and Space
Manual task and force
Human Decision and Error

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Workshops

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Problem Discussion

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Workshops and Presentations

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Examples: Student's Project

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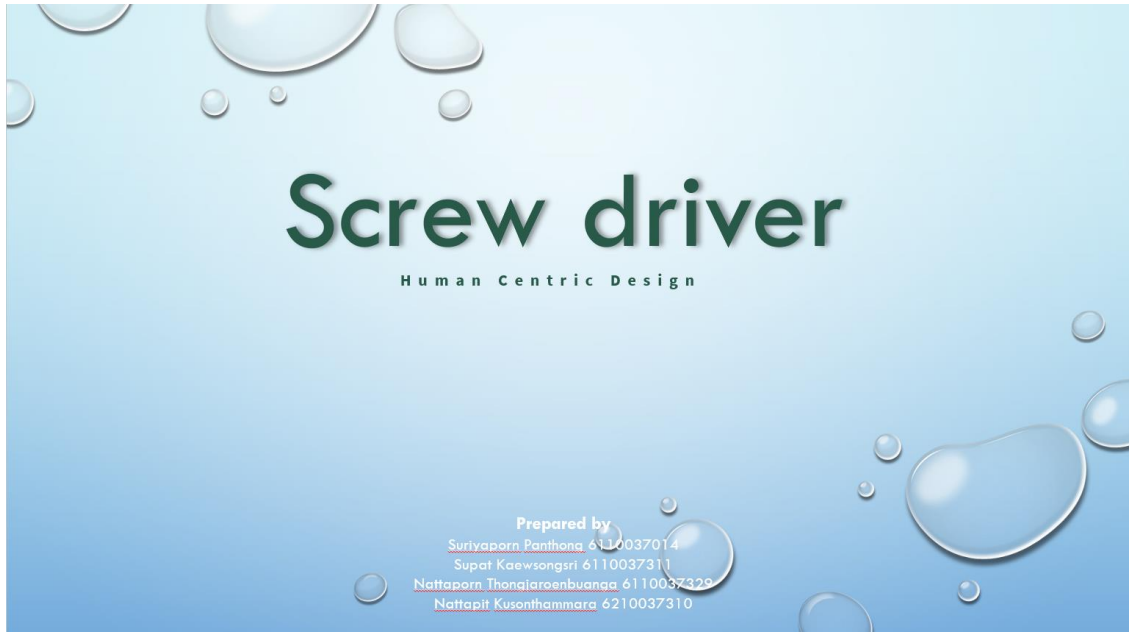

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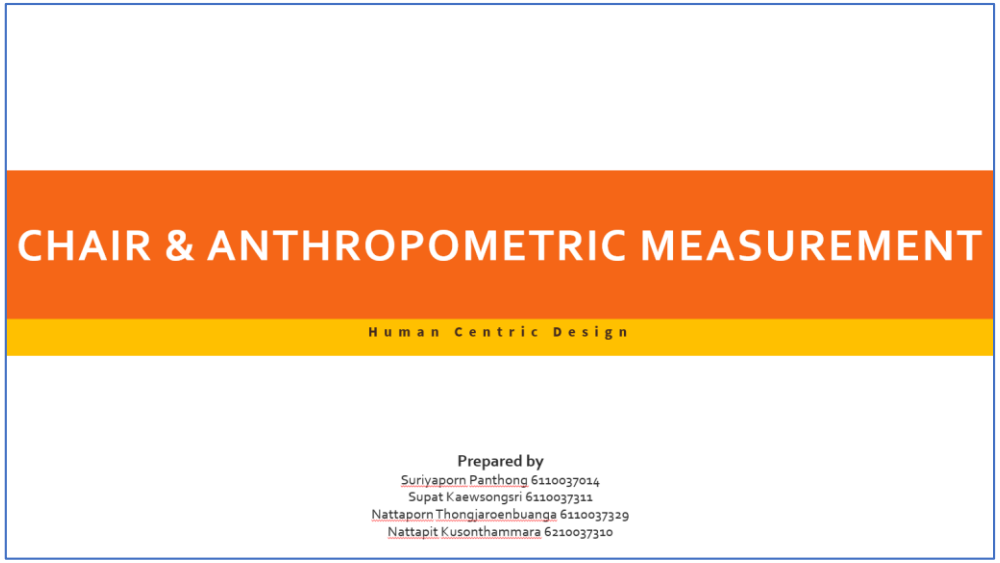
Examples: Student's Project



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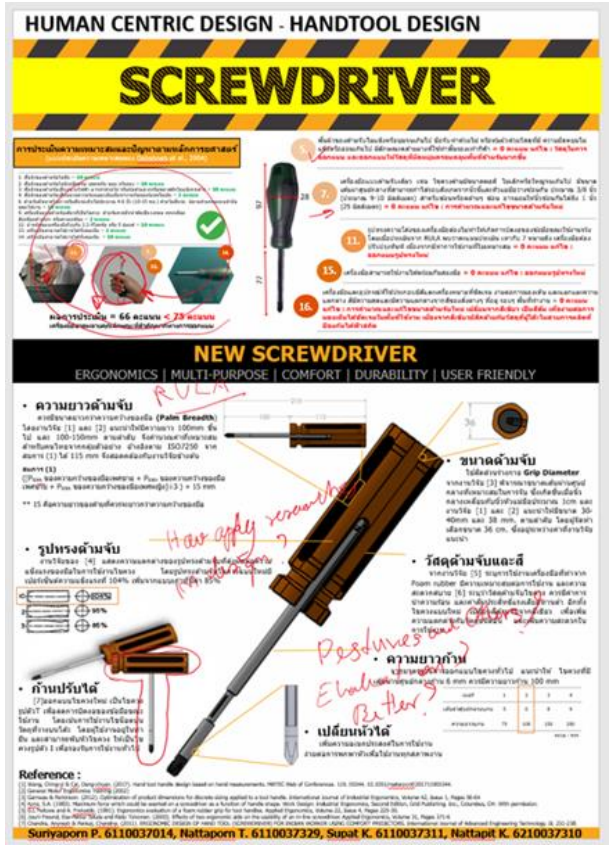
Examples: Student's Project



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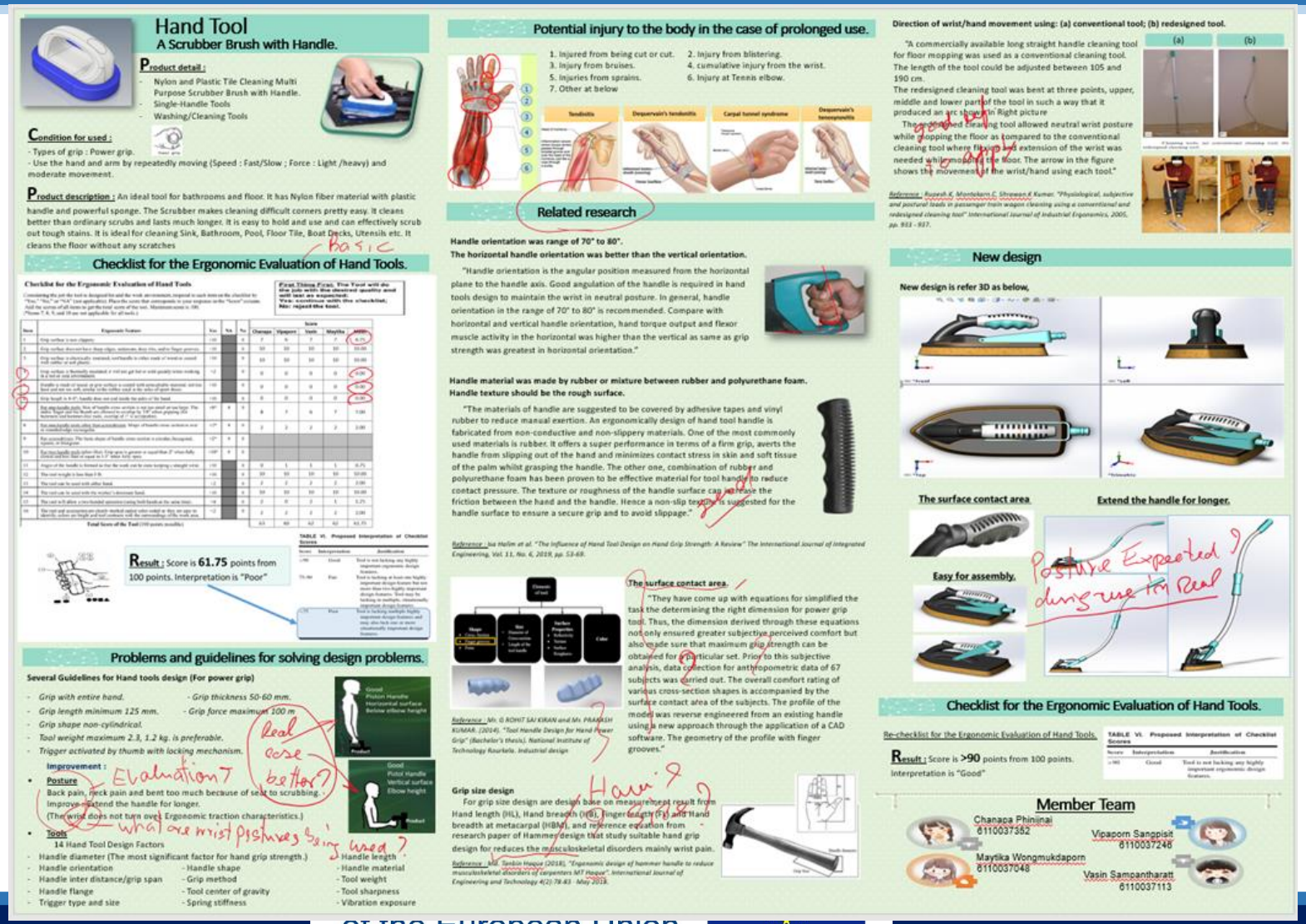
Examples: Student's Project



Course Structure Revise

The course structure will be revised after the course finish at the end of May 2020.

Adapting Problem Based Learning for Human-Centric Design Course

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Abstract

Human-centric design is a unique approach to solve problems of products, process, environments, and other human operations challenging with incompatibilities of human needs, abilities and limitations. The objective of this course is to understand, analyse, and apply the interactions among humans and other elements of a system, evaluate and design tasks, equipment, products, processes, jobs, environments and other elements in working systems including work organization in order to design and optimize human well-being and overall system performance. The course was designed by adapting problem-based learning for more practical, and divided into 4 modules (1) Basic, (2) Problem Identification, (3) Design and Intervention, and (4) Evaluation. Students will be educated all the basic knowledge of human factors related to work elements and human interaction system designs via lectures and case study discussions at the first module. During the second module, they will learn how to identify the problems related to human in several work systems by practical workshops and case studies. Individual assignments will be assigned to the students to gain their understanding. The third module will provide more skill of human-centric design in practice via workshop, laboratories and self-learning based on a project of interest. To complete the project, the students will be able to discuss and get recommendations from instructors and share their learning with other students in the class during the workshops in the third module. At the last module, the students will learn and practice more and more in evaluation tools of human-centric design techniques to increase their skill for optimizing human well-begin and system performance in their project.

Keywords: Problem Based Learning; Human-Centric Design, Human Factors and Ergonomics, Engineering Education

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Module I: Basic Knowledge

Table 2 Course Contents (Module I: Basic of Human Factors Knowledge for Human-Centric Design)

	Time (hrs)	Contents	Activities	Related CLO				
				1	2	3	4	5
Module 1: Basic of Human Factors Knowledge for Human-Centric Design	1 (2-2-0)	Introduction to Human-Centric Design (HCD) - Meaning, scope and applications of human-centric design - Basic concepts of HCD for engineering - Professional in HCD	Lecture in class Case study discussions Lecture: 2 / Workshop: 2 / Lab: 0	✓				
	2 (2-2-0)	Human characteristics: Physical / Physiological / Psychological and Cognitive /Behavioral Characteristics Stress and strain in human Human fatigue and human errors and their effect to health, accident and efficiency	Lecture in class Case study discussions Lecture: 2 / Workshop: 2 / Lab: 0	✓	✓			
	3 (2-2-0)	Human System Interaction: Manual working system, Semi-automation working system, Automation HCD for product design HCD for process and physical environmental design HCD for work organization design	Lecture in class Case study discussions Lecture: 2 / Workshop: 2 / Lab: 0	✓	✓			✓
	4 (2-2-0)	Human System Interaction: Situation Awareness and Usability Testing HCD for product design HCD for process and physical environmental design HCD for work organization design	Lecture in class Case study discussions Lecture: 2 / Workshop: 2 / Lab: 0	✓	✓			✓

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Module 2: Problem Identification

Table 3 Course Contents (Module II: Problem Identification)

	Time (hrs)	Contents	Activities			Related CLO				
						1	2	3	4	5
Module 2: Problem Identification	5 (0-6-0)	Human factors evaluation tools for identifying risk factors effecting on health, incident, accident and efficiency such as Posture Evaluation, Task Analysis, Usability Scale, Human Error Risk Assessment et.al.	Lecture and practice in class			✓	✓			
			Lecture	Workshop	Lab					
			0	6	0					
	6 (0-6-0)	Each student selects a problem of interest related to HCD Identify human factors elements related to the selected problem Analysis the problem Presentation and discussion in the class	Self-study and presentation Problem based discussion Group project for 2-3 students depending on total students in the class.			✓	✓			
			Lecture	Workshop	Lab					
			0	6	0					
	7 (0-6-0)	Final report of the problem identification Formative Assessment	Poster/Oral presentation				✓	✓		
			Lecture	Workshop	Lab					
			0	6	0					

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Module 3: Implementation & Design

Table 4 Course Contents (Module III: Intervention and Design)

	Time (hrs)	Contents	Activities			Related CLO				
						1	2	3	4	5
Module 3: Intervention & Design	8 (0-6-0)	Workstation and Workspace Design - Measurement of human dimensions and motion. - Application of human anthropometry for workstation and workspace designs - International standards related to HCD such as ISO7250, ISO14738 et.al.	Practice in class & Case study discussion					✓	✓	
			Lecture	Workshop	Lab					
			0	6	0					
	9 (0-6-0)	Design for Human Control/System Interaction (HCI/HSI) Visual/Display Control Design HCD for control centers Accessible design for special people Physical environment design for HCI/HSI	Practice in class & Case study discussion					✓	✓	
			Lecture	Workshop	Lab					
			0	6	0					
	10 (0-6-0)	Man-machine system and interaction and cognitive designs - Human perception, information and sensory receptors - Human fallibility: human information processing / memory - Visual display of static and dynamic information /designs - Human decision	Practice in class & Case study discussion					✓ ✓	✓ ✓	
			Lecture	Workshop	Lab					
			0	6	0					
	11 (0-0-9)	Design of physical environment Light, Temperature, Pressure, Noise/Auditory, and Vibration	Practice in class & Learning from laboratories			✓	✓	✓	✓	
			Lecture	Workshop	Lab					
			0	0	9					

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Module 2: Problem Identification

Table 5 Course Contents (Module IV: Evaluation, Test, and Recommendation)

	Time (hrs)	Contents	Activities			Related CLO				
						1	2	3	4	5
Module 4: Evaluation & Test & Recommendations	12 (0-6-0)	Evaluation of manual work Size and dimension evaluation Posture and strength evaluation Space and movement evaluation	Problem based discussion				✓	✓	✓	
			Lecture	Workshop	Lab					
			0	6	0					
	13 (0-6-0)	Evaluation of physical environment in design Light, Temperature, Pressure, Noise/Auditory, and Vibration	Problem based discussion				✓	✓	✓	
			Lecture	Workshop	Lab					
			0	6	0					
	14 (0-6-0)	Evaluation of HCI/HIS and Cognitive - Usability testing of human compatibility/ capacity and limitation - Usability testing of human performance - Usability testing of human error in controlling system	Problem based discussion				✓	✓	✓	
			Lecture	Workshop	Lab					
			0	6	0					
	15 (0-6-0)	Final report of evaluation and test Summative Assessment	Poster/Oral presentation					✓	✓	
			Lecture	Workshop	Lab					
			0	6	0					

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