Subject Description Form

Subject Code	ME570
Subject Title	Advanced Product Mechatronics
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Students should have basic knowledge in fundamentals of system dynamics and automatic control, familiar with control systems, computer language in Matlab. Exclusion: ME553 Product Mechatronics
Objectives	To provide students with knowledge of designing and analyzing intelligent product embedded with microcontrollers. Students will learn to integrate sensors, microcontrollers, and actuators to design intelligent products.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. possess state-of-the-art knowledge and skills in the area of advanced mechatronics in product design and analysis; b. apply their knowledge, skills and hand-on experience to design, develop, manufacture, and analyze new products with advanced mechantronics features or functions for desired needs; c. extend their knowledge of advanced mechatronics to different situations of engineering context and professional practice; and d. have recognition of the need for, and an ability to engage in life-long learning.
Subject Synopsis/ Indicative Syllabus	***Mechatronic System:*** Configuration of mechatronic systems; sensors and transducers, and signal conditioning circuits; actuators: electrical, mechanical and pneumatic; drivers; measurement and guidance of moving parts. ***Signal Processing Techniques:*** Analog and digital filters; Nyquist sampling theorem; controller design and implementation; data converters (analog-to-digital, digital-to-analog); microcontrollers and their applications; interfacing and power sources. ***Mechatronic System Analysis:*** Design and implementation; problem definition; system requirement; integration and design criteria. ***Typical Case Studies and Projects of Mechatronic Systems:*** • Design of a home security system • Analysis and design of auto-focusing in a camera lens system • Skip control of a CD player • Programming and control of robots or CNC machines • Application of mechatronics to the design of smart toys or products • Intelligent control of home appliances • Integration of ultrasonic sensors, infrared sensors, actuators, and a • microcontroller in an AGV system. • Mechatronic systems with multiple microcontrollers ***Typical Laboratory Experiments:*** • Implementation and tuning of DC motor and stepper motor controllers • Implementation of an ultrasonic sensor system • Interfacing between microcontrollers (serial or parallel)

Teaching/Learning Methodology

1. The teaching and learning methods include lectures/tutorial sessions, homework assignments, test, case study report and examination.
2. The continuous assessment and examination are aimed at providing students with integrated knowledge required for advanced product mechatronics.
3. Technical/practical examples and problems are raised and discussed in class/tutorial sessions.

Teaching/Learning Methodology	Intended subject learning outcomes			
	a	b	c	d
1. Lecture	√	√	√	√
2. Tutorial	√	√	√	√
3. Homework assignment	√	√	√	√
4. Case study report and presentation	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Homework assignment	20%	√	√	√	√
2. Test, case study report and presentation	20%	√	√		√
3. Examination	60%	√	√	√	√
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.60 \times$ End of Subject Examination + $0.40 \times$ Continuous Assessment

The continuous assessment consists of three components: homework assignments, test, and case study report & presentation. They are aimed at evaluating the progress of students study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.

The examination is used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected

Class contact:	
▪ Lecture	24 Hrs.
▪ Tutorial/Case study	15 Hrs.
Other student study effort:	
▪ Self Study	45 Hrs.
▪ Case study report preparation and presentation	21 Hrs.
Total student study effort	105 Hrs.

Reading List and References	Textbooks: 1. *Design with Microprocessors for Mechanical Engineers* by Stiffler, McGraw-Hill 2. *Introduction to Mechatronics and Measurement Systems*, by Alciatore and Histand, McGraw-Hill 3. *Mechatronics*, by Necsulescu, Prentice Hall 4. *Mechatronics - Electromechanics and Controlmechanics*, by Mill, Springer-Verlag 5. *Mechatronics - Electronic Control Systems in Mechanical Engineering*, by Bolton, Addison Wesley 6. *Mechatronics - Electronics in Products and Processes*, by Bradley, et al., Chapman and Hall 7. *Mechatronics - Mechanical System Interfacing*, by Auslander and Kempf, Prentice Hall 8. *Mechatronics System Design*, by Shetty and Kolk, PWS Publishing Journals: 1. *Transactions on Mechatronics*, IEEE and ASME 2. *Transactions on Industrial Electronics*, IEEE 3. *Transactions on Instrumentation and Measurement*, IEEE