Subject Description Form

<table>
<tr><td>Subject Code</td><td>ME567</td></tr>
<tr><td>Subject Title</td><td>Advanced Control Technology</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>5</td></tr>
<tr><td>Pre-requisite/
Co-requisite/
Exclusion</td><td>Students should have basic knowledge in System Dynamics and Control, Industrial Automation, and Mechatronics. Some working experience in Control and Automation is desirable.</td></tr>
<tr><td>Objectives</td><td>To provide students with a good understanding of advanced control technology and its applications in mechanical engineering.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
a. possess state-of-the-art knowledge and skills in the area of advanced control technology and its application to different mechanical systems;
b. apply their knowledge, skills and hand-on experience to design, develop, manufacture, and analyze mechanical systems with advanced control features or functions for desired needs;
c. extend their knowledge of advanced control technology and its application 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.</td></tr>
<tr><td>Subject Synopsis/
Indicative Syllabus</td><td>Analog Control: Controller design using state-space methods; causality of feedback systems; controllability and observability of linear systems.
Optimal Control: Motivation of optimal feedback controller design; linear quadratic optimal control; elementary theory of nonlinear feedback control; feedback linearization control.
Digital Control: Introductory digital control; sampled-data systems; anti-alias filters; sample rate selection; discrete-time systems and z-transform; digital controller design.
Microcomputer Implementation: Microcomputer implementation of controllers; introduction to system identification; self-tuning control; control of twin-rotor system; control of an inverted pendulum.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>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 control technology.
3. Technical/practical examples and problems are raised and discussed in class/tutorial sessions.

<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="4">Intended subject learning outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>1. Lecture</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Tutorial</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>3. Homework assignment</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>4. Case study report and presentation</td><td>√</td><td>√</td><td>√</td><td></td></tr>
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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	30%	√	√	√	√
2. Case study/Lab report and presentation	10%	√	√	√	
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/Laboratary	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

1. Bryson A. E., *Applied Linear Optimal Control: Examples and Algorithms*, New York, N.Y.: Cambridge University Press, latest edition.
2. Dorsey, John. *Continuous and Discrete Control Systems: Modeling, Identification, Design, and Implementation*, Boston: McGraw-Hill, latest edition.
3. Kisačanin, Branislav, *Linear Control Systems: with Solved Problems and MATLAB Examples*, New York : Kluwer Academic/Plenum Publishers, latest edition.