Subject Description Form

Subject Code	EIE3105
Subject Title	Integrated Project
Credit Value	6
Level	3
Pre-requisites	EIE2211 Logic Design and ENG2002 Computer Programming
Co-requisite/ Exclusion	Nil
Objectives	Provide students with the concepts and techniques in designing embedded software and hardware interfaces. Covering different topics of preceding core subjects, this subject emphasizes the application of knowledge in an integrated manner. Apart from various technical challenges, students will also need to address typical non-technical issues involved in conducting a project or product development.
Intended Subject Learning Outcomes	Upon completion of the subject, students will be able to: Category A: Professional/academic knowledge and skills 1. Understand technical knowledge specific to autonomous robots. 2. Integrate and apply knowledge acquired in previous subjects. 3. Design under cost constraints and with component limitations/tolerances in mind. 4. Locate and resolve practical problems on project development. Category B: Attributes for all-roundedness 5. Search, self-learn and try untaught solutions. 6. Exercise discipline and time-planning to meet deadlines. 7. Present ideas and findings effectively. 8. Work with others in a team collaboratively and exercise leadership.
Subject Synopsis/ Indicative Syllabus	1. Embedded System Hardware Details of a typical microcontroller architecture 2. Microcontroller Internal resources; Electrical characteristics of I/O pins; Timer/counter operations and interrupts; Pulse control using timer/counter; Pulse measurement using timer/counter. 3. I/O Interfacing Output-pin driving limitations; Inductive load driving; Keyboard multiplexing; LCD controllers; Sensors; A/D and D/A converters; Serial interfaces; I/O expansion techniques. 4. Embedded Software Development and Testing Embedded software issues; Tasks and events; Interrupt system: nesting, priority and latencies; C-language Programming. 5. Platform-Specific Anatomy of a Small Autonomous Robot Mechanical structures; Circuit design; Interrupts and tasks; Generic software functions and high-level algorithms; Concurrency and timing issues; Modern control technologies. 6. Project Management Time and progress management; Communication. **Laboratory Experiments:** 1. Introduction to Microcontroller Programming 2. Timer/Counter Programming 3. Interrupt Programming

<table>
<tr><td></td><td>4. Serial Port Programming
5. Interfacing

Project:
1. Hardware:
Construction of a small autonomous robot
2. Software:
Writing program to control the small autonomous robot in order to finish a number of tasks.
3. Presentation and report writing</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>
<table>
<tr><th>Teaching and Learning Method</th><th>Intended Subject Learning Outcome</th><th>Remarks</th></tr>
<tr><td>Lectures</td><td>1, 2</td><td>In lectures, students are introduced to the knowledge of the relevant fields. Students will be able to define and describe key terms and concepts. They will also be able to explain and generalize knowledge about embedded systems.</td></tr>
<tr><td>Laboratories</td><td>1, 2, 3, 4, 5</td><td>By performing hands-on practical experiments, students will be able to apply the acquired knowledge to designing solutions to embedded system problems. They will relate their observation to theories and principles. They will also evaluate performance of their design.</td></tr>
<tr><td>Quizzes</td><td>1, 2, 3</td><td>Students will develop a firm understanding and comprehension of the knowledge taught.</td></tr>
<tr><td>Final Tests</td><td>1, 2, 3</td><td>Students will develop a firm understanding and comprehension of the knowledge taught.</td></tr>
<tr><td>Project</td><td>1 - 8</td><td>It is an engineering development with objectively defined milestones during its progress. The scope to be covered shall include mechanical work, embedded software development and circuit design. It shall provide ample space for the more enthusiastic students to excel. Each student will have chances to play the role of leading the group in accomplishing subtasks assigned. Progress will be measured by functional demonstrations, logbooks and reports.</td></tr>
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Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)							
		1	2	3	4	5	6	7	8
Continuous Assessment									
1. Exercises	12%	✓	✓	✓					
2. Quizzes	12%	✓	✓	✓					
3. Practical Test	14%	✓	✓	✓					
4. Tests	4%	✓	✓	✓					
5. Project logbook	8%	✓	✓	✓	✓	✓	✓	✓	✓
6. Project report and presentation	10%	✓	✓	✓	✓	✓	✓	✓	✓
7. Project demonstration	40%	✓	✓	✓	✓	✓	✓		✓
Total	100%								

Student Study Effort Expected		
	Class contact (time-tabled):	
	• Lecture	38 Hours
	• Tutorial/Laboratory/Practical Classes	42 Hours
	• Tests/Quizzes	10 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	38 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and logbook/report writing	42 Hours
	• Project Development: preview of materials, revision, self-evaluation and testing of robots	30 Hours
	Total student study effort:	**200 Hours**

Reading List and References	1. *The AVR Microcontroller and Embedded Systems: Using Assembly and C*, M. A. Mazidi, S. Naimi, and S. Naimi, Pearson, 2014. 2. D. Lock, *Project Management,* 10th ed., Farnham: Gower, 2013.
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