Subject Description Form

Subject Code	EIE3901/IC382
Subject Title	Multidisciplinary Manufacturing Project
Credit Value	3 Training Credits
Level	3
Pre-requisite	ME39002/IC348 or EIE2901/IC2114 or AAE3103/IC381
Objectives	The subject provides opportunity for students to work in a multidisciplinary project team to accomplish realistic engineering goals. Through the project, students will apply and integrate the engineering knowledge and practical skills acquired from prior engineering subjects and industrial trainings. Students will also be able to analyse engineering problems from multiple perspectives, and synthesize a solution from ideas contributed by teammates of multiple disciplines.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to:** 1. apply engineering knowledge in carrying out an industrial project starting from problem definition, design, manufacturing, down to assembly, testing and evaluation; 2. select and use appropriate technology building blocks, components and manufacturing processes to develop a solution to meet given specifications and constraints; 3. Work collaboratively and effectively in a multidisciplinary team to accomplish mutual project goals; and 4. Communicate effectively in a multidisciplinary project team.
Subject Synopsis/ Indicative Syllabus	Students will be divided into groups to design and manufacture an engineering product that satisfy an existing demand in IC or a certain customer from the industry. Throughout the project, students will encounter situations that reinforce the following skills: 1. **Project specification**: Identification of client needs and wants; Identification of resource constraints such as time, manpower, equipment, budget; Formulation of project plan. 2. **Engineering design**: Selection of design methodology; collaborative design; Make-or-buy decisions; Design prototyping; Testing and simulation. 3. **Product manufacturing:** Material procurement; Component machining; PCB fabrication; Programming; Assembly and fine-tuning. 4. **Project collaboration:** Determination of project stages and milestones; CAD and PDM; Leadership and Collaborative decision making; Tolerances and fits; Project documentations.
Learning Methodology	Students will be divided into groups of 5-8 to design and manufacture an engineering product. Each project group will be formed by students from two or more engineering streams. The project topics will be provided by the subject supervisor team. Topics will be either initiated by supervisors or by commercial clients. All topics shall demand two or more skillsets including Mechanics, Electronics, and IT. Typical topics include: automated production equipment, mobility products, robotic toys, airframe structures, cabin installations, aircraft maintenance tools, jigs and gauges, *etc*. The subject is divided into two stages:

	• Design Stage During this period, the project team, under the guidance of the supervisors and clients, have to discover, understand and analyze the requirement of the project; and apply their knowledge to design a solution. Furthermore, students are required to search and track down parts and components with suppliers to obtain materials for the following manufacturing stage. • Manufacturing stage During this period, the project team will fabricate, test, and debug the product they designed. The supervisors will guide and monitor the groups on personal commitment, cooperation and coordination among team members. Regular group tutorials in the form of student-centred project meeting will be arranged between project group and respective supervisors.

Assessment Methods in Alignment with Intended Learning Outcomes

Assessment Methods	Weighting (%)	Intended Learning Outcomes Assessed			
		1	2	3	4
1. Quality of final product	30%	✓	✓		
2. Report	20%	✓	✓	✓	✓
3. Presentation and demonstration	20%			✓	✓
4. Reflective Journal	30%	✓	✓	✓	✓
Total	100%				

<u>Group assessment components</u>

Quality of final product will be assessed by the supervisor team during demonstration. The assessment is to determine how well the group's solution meets with client's requirement in terms of completeness and functionality. The assessment also determines how well the group has carried out the manufacturing in terms of accuracy and craftsmanship. This addresses the intended learning outcomes (1) & (2).

Report submitted at the end of project will be summative evidence of how well the group applied knowledge and made decisions collectively. Compulsory report chapters include: Technical description of final design; Justification of technology building blocks used; Critical review on project execution; and Record of internal communications. This addresses the intended learning outcomes (1), (2), (3) & (4).

<u>Individual assessment components</u>

Oral presentation and demonstration in an exhibition booth setting allow individual members to demonstrate their ability in presenting engineering contents clearly and logically. Through Q&A session supervisors can also determine the effectiveness of individual members' effort toward the final product outcomes. This addresses the intended learning outcomes (3) & (4).

Individual reflective journal serves as summative evidence of how well the student has functioned in the group and embrace the multidisciplinary collaboration concept. Compulsory journal contents include: Technical description of design and manufacturing tasks performed; Critical review of technical ideas proposed and adapted; Critical review on personal performance in the project execution and the collaboration experience. This addresses the intended learning outcomes (1), (2), (3) & (4).

Student Study Effort Required	**Class Contact:**	
	• Project works	78 Hours
	• Tutorial	12 Hours
	Other Study Effort:	**0 Hours**
	Total Study Effort:	**90 Hours**
Reading List and References	1. E. Tebeaux and S. Dragga, 'Chapter.9 Proposals and Progress Reports', in *The Essentials of Technical Communication*, 3rd ed., New York: Oxford, 2012 2. J. Abarca et al, 'Teamwork and Working in Teams', in *Introductory Engineering Design: A Projects-Based Approach*, 3rd ed., University of Colorado at Boulder, 2000. 3. J. Tropman, *Effective meetings*. Thousand Oaks, Calif.: Sage Publications, 3rd ED. 2014. 4. P. Harpum, 'Design Management', in *Engineering Project Management*, 3rd ed., N. Smith, Ed. Oxford: Blackwell, 2008, pp. 234-254. 5. Alur, Rajeev. Principles of Cyber-physical Systems. Cambridge, Massachusetts: MIT, 2015. 6. Valvano, Jonathan W. Introduction to ARM Cortex-M Microcontrollers. Fifth ed. , Jonathan W. Valvano, 2017	
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