COURSE OUTLINE

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Course Code: SKEM 4223 – Embedded Systems **Total Contact Hours: 42 hours**	**Semester: 2017/18** **Academic Session: Semester 1**

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Synopsis : This course introduces the principles and applications of embedded system. The topics emphasized are the microcontroller system architecture, software programming using C and the system design. The content covers internal peripherals such as general input and output, analogue to digital converter, serial communication interface, timer/counter and interrupt. The students will learn the technique to interface the microcontroller system with other devices in the embedded system for real world application. Students will also being introduce to ARM based embedded system and application.

LEARNING OUTCOMES

By the end of the course, students should be able to:

No.	Course Learning Outcome	Programme Outcome	Taxonomies and Soft-Skills	Assessment Methods
CO1	Analysis and design the embedded system peripherals and the software for various application	PO3	C5,P4,A2	T,F,Q,HW
CO2	Solve a design and development problems real world embedded system application through group project	PO5	C4/5,P5,A2/3	PR, Pr, D (T – Test ; PR – Project ; Q – Quiz; HW – Homework/Asgmt; Pr – Presentation; F – Final Exam, D-Demo)

Prepared by:	Certified by: (Course Panel Head)
Name: Dr. Yeong Che Fai **Signature:** **Date: 1 Sept 2017**	**Name:** **Signature:** **Date:**

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STUDENT LEARNING TIME (SLT)

Teaching and Learning Activities	Student Learning Time (hours)
1. Face-to-Face Learning	
a. Lecturer-Centered Learning i. Lecture	38
b. Student-Centered Learning (SCL) i. Laboratory/Tutorial ii. Student-centered learning activities – Active Learning, Project Based Learning	4
2. Self-Directed Learning	
a. Non-face-to-face learning or student-centered learning (SCL) such as manual, assignment, module, e-Learning, etc.	30
b. Revision	42
c. Assessment Preparations	18
3. Formal Assessment	
a. Continuous Assessment	3
b. Final Exam	3
Total (SLT)	**138(120)**

TEACHING METHODOLOGY

The teaching and learning activity will be implemented though the following method:

i. **Lecturing Method**

Lecturing is the main teaching method to provide basic understanding of concept and theory on the embedded system. However lecturing method will be combine with other method to make sure that the students stay focus

ii. **Cooperative and Collaborative Method**

This method is used to develop the interactive teaching and learning environment among students and with lecturer. Since the students come from various background and course, they can share many experience and application of embedded system. They will also participate and involve directly in problem / question solving.

iii. **Demonstration Method**

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This method will be used to explain the operation of simulation software and demonstrate the steps for using it. Beside software, this subject will use a trainer kit and this requires comprehensive demonstration to all students. The student will have the real and hands on experience in using the software and hardware

iv. **Problem Based Method**

The teaching and learning activity that is targeted for C03 is a Group Project. Usually, the nature of group project is Student Centered Approach which involves Problem Based Learning, Cooperative Learning and Presentation.

The student will be assigned into groups which consist of 2-3 students. Each group has to build a project which is an application of a system based on microcontroller device. For example a house alarms system or a digital clock. They have to discuss and come out with a title for their group project (group discussion, role play). Then they have to prepare a project proposal (role play, responsibility) and present it in front of class (presentation). Based on the comment and feedback, the group shall make improvement and immediately start developing the project (role play). Usually the project consists of software and hardware development. And the most important part in the project is the integration of both systems (role play).

At the end of the project, the group shall present the project as a whole, from planning to design, development and testing (presentation). The presentation also involves a demonstration on the actual developed system (project work, presentation). For the final task, the group has to submit a full report on the project development (project report).

WEEKLY SCHEDULE

Week 1 : **Introduction To Embedded System**
Definition of embedded system, Embeded system vs general computing system, History of embedded system, Classification, Major application area.

Week 2 : **Microcontroller for Embedded System**
Core of embedded system: General purpose and Domain specific processor, ASICs, PLDs, Commercial Off-The-Shelf Components: Characteristics and attributes: speed, memory, I/O and communication interfaces.

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Week 3-4	:	**Microcontroller Fundamental** Introduction to Atmel AVR, Atmega328 microcontroller, ATmega328 pin-out & description, ATmega328 Hardware Design, Arduino Uno Board internal architecture, families
Week 5-7	:	**Embedded System Programming** Firmware features and development languages, Arduino IDE, Arduino Programming Language, Brief Review of C Language, Software Development & Debugging Processes, Function and libraries.
Week 8	:	Mid-Semester Break
Week 9-12	:	**Real Time Interfacing** On-chip interfaces, General I/O registers, Parallel I/O interface, Analog-to-digital converter, Serial communication, Timers & interrupt, LED interfacing, mechanical switch, devices, DC & stepper motor, Introduction to Arduino Shields
Week 13-14	:	**Single Board Computer** ARM architecture and processor families, Introduction to Rasbbery PI, Hardware design and peripherals description, Introduction to OS and Linux programming, Simple application development.
Week 15	:	**Case Studies on Embedded System Design** QUAD rotor robot, Balancing Robot, etc.
Week 16-18	:	Revision Week and Final Examination

REFERENCES :

List of references.

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8. W. Bolton. Mechatronics Electronic control systems in mechanical and electrical 5th ed.. Peason Education
9. Andrew, N. Sloss, Dominic Symes, Cris Wright, 2008. ARM System Developer's Guide- Designing & Optimizing System Software. Elsevier
10. Craight Hollabaugh. Embedded Linux: Hardware, Software and Interfacing. Addison-Wesley Professional
11. http://www.raspberrypi.org

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GRADING:

(Provide details on the allocation of marks and the time schedule for all tests and assignments)

1. **Final Exam: 50%**
2. **Course Work: 50%**

Test 1	10%	Week 6
Test 2	10%	Week 13
Quiz	5%	
Assignment 1	10%	Week 1-6
Assignment 2	15%	Week 13

***Students are recommended to buy a "Starter Kit for Arduino UNO" or Raspeberry Pi.**