Subject Description Form

Subject Code	EIE3311 (for 42470 and 42375)
Subject Title	Computer System Fundamentals
Credit Value	3
Level	3
Pre-requisite	For 42470: EIE2211 Logic Design For 42375: EIE2261 Logic Design
Co-requisite/ Exclusion	Nil
Objectives	To provide a broad treatment of the fundamentals of computer systems.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Apply knowledge of mathematics, science, and engineering appropriate to a basic computer system. 2. Use computer tools with an understanding of the processes and limitations. 3. Understand the fundamentals of computer systems and associated technologies. Category B: Attributes for all-roundedness 4. Communicate effectively.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Microprocessors and Microcomputers The following topics will be discussed in detail with references to one or two well-established (contemporary) microprocessor systems. 1.1 CPU architecture: instruction fetch and execution, pipelining, instruction types, examples of assembly language programs, processor control units and micro-programmed control unit, real mode and protected mode of x86 processors, advanced processors, Graphics Processing Units (GPUs) and general-purpose computing. 1.2 Memory interface and memory management: memory devices, address decoding, memory interface, banking, bus buffering and driving, bus cycle and wait state, memory segmentation and paging. 1.3 Basic I/O interface: memory-mapped I/O, I/O port address decoding, programmable peripheral interface, handshaking. 1.4 Interrupts: polling, programmed I/O, interrupt I/O; basic interrupt processing, software interrupt, expanding the interrupt structure. 1.5 Direct Memory Access and DMA-controlled I/O: basic DMA operation, DMA controller, shared-bus operation. 1.6 Cache memory: mapping, associativity, replacement policies, write policies, performance. 1.7 Computer buses: evolution of bus architectures, PCI (PCIe) local bus, USB bus 2. Introduction to Operating System 2.1 File systems: secondary memory, disk formatting, file allocation table, file management, directory entry and file control block. 2.2 Multitasking and time-sharing: time-slicing, process states and process control block, context-switching mechanism, scheduling schemes and process priorities.

	2.3 Boot-up ROM, firmware, hardware, device drivers. 2.4 Extension of OS and computing system to cloud Computing. 3. Computer Arithmetic 3.1 Data formats: signed/unsigned numbers, binary/decimal/BCD numbers, ASCII, fixed/floating point numbers, IEEE standard. 3.2 Arithmetic algorithms: fast addition, multiplication and division algorithms. **Laboratory Experiment:** 1. x86 registers and memory architecture 2. x86 assembly language programming 3. Cache memory 4. I/O interface and Interrupt I/O
Teaching/ Learning Methodology	(see table below)

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures	1, 2, 3	fundamental principles and key concepts of the subject are delivered to students
Tutorials and Assignments	1, 2, 3, 4	supplementary to lectures and are conducted with a smaller class size; students will be able to clarify concepts and to have a deeper understanding of the lecture material; problems and application examples are given and discussed Students take home more questions after each tutorial session and hand in their answers in the subsequent tutorial session
Laboratory sessions	1, 2, 3, 4	students will make use of a x86 assembler and debugger to develop an assembly program; software to simulate various OS management techniques and evaluate their performance; and circuit board to study various interfacing techniques and evaluate their efficiency and performance

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/ Task	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**			
		1	**2**	**3**	**4**
1. Continuous Assessment (Total: 50%)					
• Assignments	15%	✓	✓	✓	✓
• Laboratory Exercises	10%	✓	✓	✓	✓
• Tests	25%	✓		✓	✓
2. Examination	50%	✓		✓	✓
Total	100%				

The continuous assessment consists of short quizzes, assignments, laboratory reports and tests.

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

Specific Assessment Methods/Tasks	**Remark**
Assignments, tests and examination	end-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom;
Laboratory exercises	each student is required to produce a written report; accuracy and the presentation of the report will be assessed;

Student Study Effort Expected

Class contact (time-tabled):	
• Lecture	24 Hours
• Tutorial/Laboratory	15 hours
Other student study effort:	
• Lecture/Tutorial: preview/review of notes; assignments; preparation for test/examination	54 Hours
• Laboratory: preview of materials, revision and/or reports writing	12 Hours
Total student study effort:	**105 Hours**

Reading List and References

Reference Books:

1. B.B. Bery, The Intel Microprocessors 8086/8088, 80186/80188, 8086, 80386, 80486, Pentium, Pentium pro processor, Pentium II, Pentium III, Pentium 4 and Core2 with 64-bit extensions: Architecture, Programming, and Interfacing, 8th ed., Pearson Prentice Hall, 2009.
2. C. Hamacher, Z. Vranesic, S. Zaky, and N. Manjikian, Computer Organization and Embedded Systems, 6th ed., McGraw-Hill, 2012.
3. W. Stallings, Computer Organization & Architecture: Designing for Performance, 10th ed., Prentice Hall, 2016.

	4. Muhammad A. Mazidi and Janice G. Mazidi, The 80x86 IBM PC and Compatible Computers: Assembly Language, Design, and Interfacing, International Edition, 5th ed., Pearson Education, 2010. 5. J. Uffenbeck, The 80x86 Family: Design, Programming, and Interfacing, 3rd ed., Prentice Hall, 2002. 6. T. Erl, Z Mahmood, and R. Puttini, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, 2013.
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Prepared by	Dr Lawrence Cheung