Akashi College	Year	2023	Course Title	Advanced Electronic Circuit

Course Information

Course Code	5035	Course Category	Specialized / Elective
Class Format	Lecture	Credits	Academic Credit: 2
Department	Mechanical and Electronic System Engineering	Student Grade	Adv. 2nd
Term	First Semester	Classes per Week	2
Textbook and/or Teaching Materials			
Instructor	INOUE Kazunari		

Course Objectives

This course will teach VLSI devices, circuit design and simulation in lecture and exercise formats. The objective is to correctly understand the CMOS logic circuit, apply it to computer and control circuits, learn the features of various memory LSIs, and understand the roadmap for electronic circuit technology. Furthermore, the aim is to understand the challenges and measures that have been taken in the specialized electronic circuits field in recent years, such as low power consumption and reliability technologies.

Rubric

	Ideal Level	Standard Level	Unacceptable Level
Achievement 1	Fully understand circuit design and operation verification techniques.	Understand circuit design and operation verification techniques.	Do not understand circuit design and operation verification techniques.
Achievement 2	Fully understand technologies for low power consumption and high speed.	Understand technologies for low power consumption and high speed.	Do not understand technologies for low power consumption and high speed.
Achievement 3	Fully understand high-density memory circuit technologies such as SRAM, DRAM, and Flash.	Understand high-density memory circuit technologies such as SRAM, DRAM, and Flash.	Do not understand high-density memory circuit technologies such as SRAM, DRAM, and Flash.

Assigned Department Objectives

Teaching Method

Outline	VLSI devices have achieved remarkable development in three key areas: higher speed, lower power consumption, and higher integration. The course will lecture on circuit and architecture technologies regarding high-performance design techniques for achieving them. In this course, lessons will be conducted in a lecture style format. Students will be introduced to the high-performance design electronic circuits of recent years by faculty members with practical experience in memory and application processor design.
Style	Classes will be taught in lecture and exercise formats for the following numbers 1) to 3). There will be no exams, and evaluation will be based on the submitted assignment. 1) Understand circuit design and operational verification technologies. 2) Understand technologies for low power consumption and high speed. 3) Understand high-density memory circuit technologies such as SRAM, DRAM, and Flash.
Notice	This course's content will amount to 90 hours of study in total. These hours include the learning time guaranteed in classes and the standard self-study time required for pre-study / review, and completing assignment reports. Students who miss 1/3 or more of classes will not be eligible for evaluation.

Characteristics of Class / Division in Learning

☐ Active Learning	☑ Aided by ICT	☑ Applicable to Remote Class	☐ Instructor Professionally Experienced

Course Plan

			Theme	Goals
1st Semester	1st Quarter	1st	Lecture overview and trends toward higher performance VLSI Explain the lecture overview for Advanced Electronic Circuits.	Lecture overview and trends toward higher performance VLSI Understand the lecture overview for Advanced Electronic Circuits.
		2nd	nMOS/pMOS transistors and CMOS inverters Explain nMOS/pMOS transistor and CMOS inverter operation.	nMOS/pMOS transistors and CMOS inverters Understand nMOS/pMOS transistor and CMOS inverter operation.
		3rd	CMOS logic circuits Explain the various CMOS logic circuits.	CMOS logic circuits Understand CMOS logic circuits.
		4th	Combinational circuits using CMOS Explain the combinational circuits that are composed of CMOS logic circuits.	Combinational circuits using CMOS Understand the combinational circuits that are composed of CMOS logic circuits.
		5th	CMOS-based sequential circuits Explain the sequential circuits that are composed of CMOS logic circuits.	CMOS-based sequential circuits Understand the sequential circuits that are composed of CMOS logic circuits.
		6th	LSI manufacturing process Explain topics such as silicon substrates, gate oxide film formation, and ion injection.	LSI manufacturing process Understand topics such as silicon substrates, gate oxide film formation, and ion injection.
		7th	VLSI design Explain functional design, hardware description language and verification in LSI design.	VLSI design Understand functional design, hardware description language and verification in LSI design.
		8th	Volatile memory circuits Explain SRAM and DRAM circuit configuration and operation.	Volatile memory circuits Understand SRAM and DRAM circuit configuration and operation.

	2nd Quarter	9th	Non-volatile memory circuits Explain non-volatile memory circuit configuration and operation.	Non-volatile memory circuits Understand non-volatile memory circuit configuration and operation.
		10th	Circuit design exercises using SPICE 1 Explain circuit inputs using SPICE.	Circuit design exercises using SPICE 1 Understand circuit inputs using SPICE.
		11th	Circuit design exercises using SPICE 2 Explain circuit inputs and operation verification using SPICE.	Circuit design exercises using SPICE 2 Understand circuit inputs and operation verification using SPICE .
		12th	Circuit design using SPICE; Assignment submission 1 Solve the problems regarding circuit inputs and operation verification using SPICE.	Circuit design using SPICE; Assignment submission 1 Solve the problems regarding circuit inputs and operation verification using SPICE.
		13th	Circuit design using SPICE; Assignment submission 2 Solve and submit the problems regarding circuit inputs and operation verification using SPICE.	Circuit design using SPICE; Assignment submission 2 Solve the problems regarding circuit inputs and operation verification using SPICE.
		14th	Testing and reliability design Explain coverage and design for testability.	Testing and reliability design Understand coverage and design for testability.
		15th	Summary and future trends Explain topics such as more than Moore, IoT sensor nodes, and other future development trends in VLSI technology.	Summary and future trends Understand topics such as more than Moore, IoT sensor nodes and other future development trends in VLSI technology.
		16th	No final exam	

Evaluation Method and Weight (%)

	Assignments						Total
Subtotal	100	0	0	0	0	0	100
Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	100	0	0	0	0	0	100
Cross Area Proficiency	0	0	0	0	0	0	0