EEE Courses in Academic Year 2017-2018

Course Code & Title	EE1002 - PHYSICS FOUNDATION FOR ELECTRICAL & ELECTRONIC ENGINEERING
Study Year	1 ; 2
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Zhang Qing (Semester 1) ; Assoc Prof Rusli (Semester 2)
Learning Objective	This course aims to build a strong and relevant Physics foundation for students enrolled in the School of Electrical and Electronic Engineering (EEE) over and above what they did in the first semester Physics course in the first year under the common engineering curriculum. This course will focus on fundamental concepts that are keys to EEE students in preparation for their subsequent studies in EEE. It is different from the traditional first year Physics course in that it is geared more towards an understanding of the basic principles related to common electrical and electronic devices and equipment that are important in the course of their studies and future engineering practices. In doing so, it will encourage students to appreciate the relationship between the concepts in Physics and their applications in EEE.
Course Contents	Introduction to electromagnetic fields and applications. Electromagnetic in electronics, circuits and communications. Introduction to light, lasers and optical spectroscopy. Principles of geometric and wave optical components. Introduction to quantum physics and applications. Applications of quantum physics in electronics and lasers.
Prerequisite	PH1011 Physics or PH1012 Physics A
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24); Laboratories (6)
Academic Units	4
Assessment Modes	Continuous Assessment (40%) – Quizzes; Homework Assignment; Laboratory Assessment Written Examination (60%)
Textbook(s)	• Serway, Raymond A and Jewett John W, Physics for Scientists and Engineers with Modern Physics, 9th Edition, Brooks/Cole, 2014. (QC23.S492P 2014)
Reference(s)	• Randall D. Knight, Physics for scientists and engineers. (QC23.2.K71 2004) • Giancoli Douglas C, Physics for Scientists & Engineers with Modern Physics, 4th Edition, Pearson Prentice Hall, 2009. (QC21.2.G433 2009). • Young Hugh D, Freedman Roger A, Ford A Lewis and Sears Francis Weston, University Physics: with Modern Physics, 13th Edition, Addison-Wesley, 2012. (QC21.2.Y72U 2012) • Walker Jearl, Halliday David and Resnick Robert, Fundamentals of Physics, 10th Edition, Wiley, 2014 (QC21.3.W181 2014 EXTENDED)

Course Code & Title	EE1003 - INTRODUCTION TO MATERIALS FOR ELECTRONIC
Study Year	1
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Wang Hong
Learning Objective	The subject of Materials for Electronics has been one of the key drivers for the advancement of Science and Technology. This course aims to build the foundation and inspire the interest of freshmen enrolled in the School of Electrical and Electronic Engineering (EEE) after completing the first semester common engineering curriculum. This course will focus on fundamental concepts and basic principles that are related to the Materials for Electronics and the latest progress in this field.
Course Contents	Materials and Society. Bond potentials, valance charge, crystal structures and defects. Ceramics for electronics. Semiconductor materials. Nanostructures and nanoelectronics. Organic electronics.
Prerequisite	Nil
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments; Class Participation Written Examination (60%)
Textbook(s)	• Callister William D and Rethwisch David G, Materials Science and Engineering: an introduction, 9th edition, John Wiley & Sons, 2014. (TA403.C162 2014)
Reference(s)	• Smith William F and Hashemi Javad, Foundations of Materials Science and Engineering, 5th Edition, McGraw-Hill, 2010. (TA403.S663 2010) • Serway Raymond A and Jewett John W, Physics for Scientists and Engineering with Modem Physics, 9th Edition, Brooks/Cole, 2014. (QC23.S492P 2014) • Kasap Safa O, Principles of Electronic Materials and Devices, 3rd Edition, McGraw-Hill, 2006. (TK453.K19 2006)

Course Code & Title	EE1071 – INTRODUCTION TO EEE LABORATORIES

Study Year	1
Availability	Semester 2
Coordinator(s)	Dr Ong Keng Sian, Vincent
Learning Objective	The objective of this course is to acquaint students, especially those without any technical background, with EEE laboratory equipment.
Course Contents	This course consists of 6 hours of Lecture/briefing and a total of 6 lab modules, 2 modules each on Laboratory Basics, Working with AC waveforms and Soldering and circuit-building. 1. Lecture/Briefing - Introduction to common measuring instruments. Electrical components and concepts of simple circuit analysis. Data recording and analysis. General safety aspects. 2. Laboratory Basics (Modules 1 & 2) - Safety in EEE laboratory sessions. Understanding breadboard set up. Understanding resistor colour bands, capacitors. Use of DC power supplies. Use of digital multimeters. Practice on connecting simple circuits on the breadboard and taking DC voltage and current measurements. 3. Working with AC Waveforms (Modules 3 & 4) - Understanding and using of oscilloscopes. Understanding and using waveform generators. Practice on building AC circuits on the breadboard and taking measurements using oscilloscopes. 4. Soldering and circuit-building (Modules 5 & 6) - Soldering of electronic components. Practice by building circuits on a PCB and taking measurements using oscilloscopes and digital multimeters.
Prerequisite	Nil
Contact Hours	Lecture & Briefing (6); Laboratory (18)
Academic Unit	1
Assessment Modes	Continuous Assessment (100%) – Practical Assessments; Formal Report

Course Code & Title	EE2001 – CIRCUIT ANALYSIS
Study Year	2
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Soh Cheong Boon (Semester 1) ; Assoc Prof Dauwels, Justin (Semester 2)
Learning Objective	This course focuses on the fundamental principles of circuit theorems and circuit elements, DC/AC and three-phase circuits, transient and steady-state responses, circuit analysis using Laplace transforms.
Course Contents	Circuit Theorems. Energy Storage Elements and Transient Response. Laplace Transforms in Circuit Analysis. Network Functions and Two-port Networks. Alternating Current Circuits. Balanced Three Phase Circuits.
Prerequisite	Nil
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24); Laboratories (6)
Academic Units	4
Assessment Modes	Continuous Assessment (40%) – Quiz; Homework Assignments; Laboratory Assessment Written Examination (60%)
Textbook(s)	• Alexander Charles K and Sadiku Matthew N O, Fundamentals of Electric Circuits, 5th Edition, McGraw-Hill, 2013. (TK454.A375 2013)
Reference(s)	• Hayt William Hart, Kemmerly Jack Ellsworth and Durbin Steven M, Engineering Circuit Analysis, 8th Edition, McGraw Hill, 2012. (TK454.H426 2012) • Nilsson James William and Riedel Susan A, Electric Circuits, 9th Edition, Pearson/Prentice-Hall, 2011. (TK454.N712 2011)

Course Code & Title	EE2002 – ANALOG ELECTRONICS
Study Year	2
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Siek Liter (Semester 1) ; Assoc Prof Chang Chip Hong (Semester 2)
Learning Objective	This course serves as an introductory analog electronic course. The course offers a broad range of fundamental electronic device and circuit topics. The specific materials pertain to analog electronics including diodes, bipolar-junction transistors (BJT), Metal Oxide Semiconductor Field Effect Transistors (MOSFET), basic amplifier configurations, multistage amplifier and differential amplifiers, current sources and current mirrors, frequency response and operational amplifiers. This basic course in analog electronics provides for analysis and design of analog electronic circuits, both discrete and integrated, required of an electronics engineer.
Course Contents	Diode circuit analysis. Bipolar junction transistors. MOSFET devices. Small-signal amplifiers. Multistage and differential amplifiers. Current Sources and Current Mirrors. Frequency response. Operational amplifiers. Applications.
Prerequisite	EE2001 Circuit Analysis
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24); Laboratories (9)

Academic Units	4
Assessment Modes	Continuous Assessment (40%) – Quiz; Homework Assignments; Practical Work Written Examination (60%)
Textbook(s)	• Jaeger Richard C & Blalock Travis N, Microelectronic Circuit Design, 5th Edition, McGraw-Hill, 2016. (TK7874.J22m 2016)
Reference(s)	• Sedra Adel S and Smith Kenneth Carless, Microelectronic Circuits, 7th Edition, Oxford University Press, 2015. (TK7867.S449 2015) • Franco Sergio, Design with Operational Amplifiers and Analog Integrated Circuits, 4th Edition, McGraw-Hill, 2015. (TK7874.F825 2015)

Course Code & Title	EE2003 – SEMICONDUCTOR FUNDAMENTALS
Study Year	2
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Tang Dingyuan (Semester 1) ; Assoc Prof Wang Qijie (Semester 2)
Learning Objective	This course covers the principles and fundamentals of semiconductor electronic and photonic devices and their applications. The objective is to provide students with the necessary basic understanding and knowledge in semiconductors so that they will understand the theory and operation of electronic devices for applications in discrete and integrated analogue electronic circuits. These are also crucial to the learning of state-of-the-art and future semiconductor and photonic devices and their applications. This course also serves as an introductory course to other more advance and specialized semiconductor and photonic courses that will be taught at the final year undergraduate level.
Course Contents	Basic Semiconductor Concepts. Semiconductor in Equilibrium and Carrier Transport Phenomena. Semiconductor in Non-Equilibrium. PN Junction and Metal-Semiconductor Contacts. Bipolar Junction Transistor and Metal Oxide Field Effect Transistor. Optoelectronic Devices.
Prerequisite	EE1002 Physics Foundation for Electrical and Electronic Engineering
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24); Laboratories (6)
Academic Units	4
Assessment Modes	Continuous Assessment (40%) – Quiz; Homework Assignment; Practical Work Written Examination (60%)
Textbook(s)	• Neamen Donald A, Semiconductor Physics and Devices: Basic Principles, 4th Edition, McGraw-Hill, 2012. (QC611.N348 2012)
Reference(s)	• Streetman Ben G and Banerjee Sanjay Kumar, Solid State Electronic Devices, 7th Edition, Pearson/Prentice-Hall, 2015. (TK7871.85.S915 2015) • Sze S M, Semiconductor Devices, Physics and Technology, 3rd Edition, John Wiley, 2012. (TK7871.85.S997 2012) • Kasap Safa O, Principles of Electronic Materials and Devices, 3rd Edition, McGraw-Hill, 2006. (TK453.K19 2006)

Course Code & Title	EE2004 – DIGITAL ELECTRONICS
Study Year	2
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Lim Meng Hiot (Semester 1) ; Assoc Prof Gwee Bah Hwee (Semester 2)
Learning Objective	This course serves as a foundation course on digital electronics. It covers a broad range of fundamental digital circuits. The concepts of digital signals, number systems, logic gates, switching algebra and logic minimization techniques, basic combinatorial and digital circuits and their application in more complex digital systems are to be imparted to the students.
Course Contents	Digital Fundamentals. Digital Circuits; Combinational Logic Principles. Combinational Logic Circuits. Sequential Logic Principles. Sequential Logic Circuits. Memory, CPLDs, and FPGAs.
Prerequisite	Nil
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24); Laboratories (9)
Academic Units	4
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments/Tests; Practical Work Written Examination (60%)
Textbook(s)	• Wakerly John F, Digital Design: Principles and Practices, 4th Edition, Pearson Prentice-Hall, 2006. (TK7874.W149 2006)
Reference(s)	• Roth Charles H and Kinney Larry L, Fundamentals of Logic Design, 7th Edition, Cengage Learning, 2014. (TK7868.L6R845 2014) • Marcovitz Alan B, Introduction to logic design, 3rd Edition, McGraw-Hill, 2010. (TK7868.L6M321 2010)

- Mano M Morris and Ciletti Michael D, Digital Design: With a Introduction to the Verilog HDL, 5th Edition, Pearson Prentice Hall, 2013. (TK7888.3.M285 2013)

Course Code & Title	EE2006 – ENGINEERING MATHEMATICS I
Study Year	2
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Wong Jia Yiing, Patricia (Semester 1) ; Assoc Prof Teoh Eam Khwang (Semester 2)
Learning Objective	Mathematics plays a fundamental role in understanding the working of engineering systems. The purpose of the course is to serve as a baseline course for all future engineering subjects. The objectives include equipping students with: (a) basic understanding of topics related to engineering mathematics like Fourier series, Fourier and Laplace transforms, partial differential equations, numerical methods, probability and mathematical statistics; (b) skills and techniques for solving these problems.
Course Contents	Fourier Analysis. Laplace Transform. Partial Differential Equations. Numerical Methods. Probability. Mathematical Statistics.
Prerequisite	MH1811 Mathematics 2 or MH2810 Mathematics A
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24)
Academic Units	4
Assessment Modes	Continuous Assessment (40%) – Quizzes; Homework Assignments Written Examination (60%)
Textbook(s)	• Kreyszig Erwin, Herbert Kreyszig and Nominton E J, Advanced Engineering Mathematics, 10th Edition, John Wiley, 2011. (QA401.K92 2011) • Johnson Richard Arnold and Bhattacharyya Gouri K, Statistics: Principles and Methods, 6th Edition, John Wiley, 2010. (QA276.12.J68 2010) • Patricia J. Y. Wong and Sundararajan N., Engineering Mathematics, McGraw-Hill, 2010.
Reference(s)	• O'Neil Peter V, Advanced Engineering Mathematics, 7th Edition, Cengage Learning, c2012. (TA330.N58 2012) • James Glyn, Advanced Modern Engineering Mathematics, 4th Edition, Pearson, 2011. (TA330.A244 2011) • Milton J Susan and Arnold Jesse C, Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences, 4th Edition, McGraw-Hill, 2003. (TA330.M662 2003) • Singh Ravish R and Bhatt Mukul, Engineering Mathematics, McGraw Hill, 2010. (TA333.S617)

Course Code & Title	EE2007 – ENGINEERING MATHEMATICS II
Study Year	2
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Ling Keck Voon (Semester 1) ; Assoc Prof Chua Chin Seng (Semester 2)
Learning Objective	Mathematics plays a fundamental role in understanding the working of engineering systems. The purpose of the course is to serve as a baseline course for all future engineering subjects. The objectives include equipping students with: 1) Basic understanding of topics related to engineering mathematics like linear algebra, complex variables and vector differential and integral calculus; 2) Skills and techniques for solving these problems.
Course Contents	Linear Algebra. Complex Variables. Vector Differential Calculus. Vector Integral Calculus.
Prerequisite	MH1811 Mathematics 2 or MH2810 Mathematics A
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24)
Academic Units	4
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Class Participation Written Examination (60%)
Textbook(s)	• Kreyszig Erwin, Herbert Kreyszig and Nominton E J, Advanced Engineering Mathematics, 10th Edition, John Wiley, 2011. (QA401.K92 2011)
Reference(s)	• DeGranza and Gagliardi, Introduction to Linear Algebra with Applications, McGraw-Hill, 2009. (QA184.2.D316) • David C. Lay, Steven R. Lay and Judi J. McDonald, Linear Algebra and its Applications, 5th Ed. Person, 2015.

Course Code & Title	EE2008 – DATA STRUCTURES AND ALGORITHMS
Study Year	2
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Huang Guangbin (Semester 1) ; Assoc Prof Low Chor Ping (Semester 2)
Learning Objective	This course aims to give a systematic introduction to data structures and algorithms for constructing efficient computer programs. Emphasis is on data abstraction issues in program development process, and on the design of

	efficient algorithms. Simple algorithmic paradigms such as greedy algorithms, divide-and-conquer algorithms and dynamic programming will be introduced. Elementary analyses of algorithmic complexities will also be taught.
Course Contents	Introduction. Principles of algorithm analysis. Data structures. Searching. Search Trees, Sorting. Algorithm design techniques.
Prerequisite	Nil
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24); Laboratories (6)
Academic Units	4
Assessment Modes	Continuous Assessment (40%) – Quiz; Homework Assignments; Practical Works Written Examination (60%)
Textbook(s)	• Huang Guangbin and Ng Jim Mee, Data Structures and Algorithms, Pearson Education, 2007. (QA76.9.D35D232DS)
Reference(s)	• Johnsonbaugh Richard and Schaefer Marcus, Algorithms, Pearson Education, 2004. (QA76.9.A43J65) • Levitin Anany, Introduction to the Design & Analysis of Algorithms, 3rd Edition, 2012. (QA76.9.A43L666 2012) • Michael Goodrich and Robert Tamassia, Algorithm Design: Foundations, Analysis, & Internet Examples, 2002. (QA76.9.A43G655)

Course Code & Title	EE2010 – SIGNALS AND SYSTEMS
Study Year	2
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Ma Kai-Kuang (Semester 1) ; Assoc Prof Teh Kah Chan (Semester 2)
Learning Objective	Signals and Systems provides basic concepts of signals, Fourier analysis, and linear time invariant systems in a generic engineering context with applications in control engineering, communications and signal processing. This course brings continuous-time and discrete-time concepts together in a unified way and relates them through sampling theory.
Course Contents	Signals and Systems. Linear Time-Invariant Systems. Fourier Representation of Signals and LTI Systems. Sampling. Modulation.
Prerequisites	(MH1810 Mathematics I & MH1811 Mathematics II) or MH2810 Mathematics A
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24); Laboratories (6)
Academic Units	4
Assessment Modes	Continuous Assessment (40%) – Quizzes; Homework Assignments; Practical Works Written Examination (60%)
Textbook(s)	• M. J. Roberts, Fundamentals of Signals and Systems, McGraw-Hill, International Edition, 2008. (TK5102.9.R646F)
Reference(s)	• Oppenheim Alan V, Willsky Alan S and Nawab Syed Hamid, Signals and Systems, 2nd Edition, Prentice-Hall, 1997. (QA402.P62 1997) • Haykin Simon S and Van Veen Barry, Signals and Systems, Wiley, 2nd Edition, 2003. (TK5102.5.H419) • Mandal Mrinal Kr and Asif Amir, Continuous and Discrete Time Signals and Systems, 1st Edition, Cambridge University Pres, 2007. (QA402.M271) • Hwei Hsu, Schaums Outlines Signals and Systems, 3rd Edition, McGraw Hill, 2013.

Course Code & Title	EE2073 – INTRODUCTION TO EEE DESIGN & PROJECT
Study Year	2
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Shum Ping, Perry
Learning Objective	To inspire students' interest in learning through active participations in the laboratory-based and practice-oriented course on the solutions of typical engineering system design and implementation problems covering multi-disciplinary areas of electrical, electronic and computer engineering.
Course Contents	Data Acquisition System and Application. Electronic Circuit and System Design. LabVIEW Software Design and Development. Prescribed Project for the Course.
Prerequisite	Nil
Contact Hours	Lectures (6); Laboratories (33)
Academic Units	2
Assessment Modes	Continuous Assessment (100%) – Practical Works
Textbook(s)	• Bishop Robert H, Learning with LabView 8, Pearson Prentice Hall, 2007. • Tooley Mike, Electronic Circuit - Fundamental and Application [Electronic Resource], 3rd Edition, Elsevier, 2006.

Course Code & Title	EE3001 – ENGINEERING ELECTROMAGNETICS

Study Year	3
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Aditya, Sheel (Semester 1) ; Assoc Prof Tan Eng Leong (Semester 2)
Learning Objective	A good understanding of the fundamental principles underlying the theory of electromagnetic fields and waves and the ability to apply this theory to the solution of simple engineering problems.
Course Contents	Static electric and magnetic fields. Maxwell's equations. Wave equation and uniform plane waves. Electromagnetic energy transfer. Reflection of electro-magnetic waves. Transmission lines.
Prerequisite	EE2007 Engineering Maths II
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24); Laboratories (6)
Academic Units	4
Assessment Modes	Continuous Assessment (40%) – Quiz; Class Participation; Practical Work Written Examination (60%)
Textbook(s)	• Sadiku Matthew N O, Elements of Electromagnetics, 6th Edition, Oxford University Press, 2015. • Hayt William Hart and Buck John A, Engineering Electromagnetics, 8th Edition, McGraw-Hill, 2012.
Reference(s)	• Ulaby Fawwaz Tayssir, Electromagnetics for Engineers, Pearson Prentice-Hall, 2005. (QC760.U36E)

Course Code & Title	EE3002 - MICROPROCESSORS
Study Year	3
Availability	Semester 1 ; Semester 2
Coordinator(s)	Dr Chan Chee Keong
Learning Objective	This is an introductory course about the fundamentals of ARM microprocessors. It covers the ARM architecture, hardware interface, software programming in assembly language as well as C language. It will also introduce students to the system-on-chip concept and the use of ARM as a microcontroller.
Course Contents	Introduction to ARM core and programmer's model. Assembler Directives. Loads, Stores and Addressing. Logic and Arithmetic. Flow control instructions. Subroutines, Stacks and Exception Handling. Thumb Instructions and C language. Peripherals Interfacing.
Prerequisite	Nil
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24); Laboratories (6)
Academic Units	4
Assessment Modes	Continuous Assessment (40%) – Quizzes; Practical Works Written Examination (60%)
Textbook(s)	• Hohl William, Christopher Hinds, ARM Assembly Language: Fundamentals and Techniques, 2nd edition, CRC Press, 2014.
Reference(s)	• Lewis Daniel Wesley, Fundamentals of Embedded Software: with the ARM Cortex-M3, 2nd Edition, Prentice Hall, 2013. (TK7895.E42L673 2013) • Sloss Andrew N, Symes Dominic and Wright Chris, ARM System Developer's Guide: Designing and Optimizing System Software, Elsevier / Morgan Kaufmann. 2004. (QA76.76.D47S634) • Patterson David A and Hennessy John L, Computer Organization and Design: The Hardware/Software Interface, (ARM edition), 5th Edition, Morgan Kaufmann, 2014. (QA76.9.C643P317 2014)

Course Code & Title	EE3010 – ELECTRICAL DEVICES AND MACHINES
Study Year	3
Availability	Semester 1 ; Semester 2
Coordinator(s)	Dr Lee Peng Hin (Semester 1) ; Assoc Prof So Ping Lam (Semester 2)
Learning Objective	The objective of the first module is to introduce students to electromagnetic principles and actuators including magnetic circuits and energy conversion devices. The second module focuses on the operating principles of single-phase and three-phase transformers and their applications in power supply systems. The third module enables students to understand the basic concepts of DC machines with particular focus on their operating characteristics. Applications of these concepts in solving engineering problems will also be covered. The final module furthers the students' knowledge on AC electrical machinery such as induction machines and synchronous machines which are widely used in industry.
Course Contents	Electromagnetic Principles and Actuators. Transformers. DC Machines. AC Machines.
Prerequisite	EE2001 Circuit Analysis
Contact Hours	Lectures (26); Tutorials (12); Laboratories (6)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments; Practical Works

Written Examination (60%)

Textbook(s)
- Guru Bhag S and Hiziroglu Huseyin R, Electric Machinery and Transformers, 3rd Edition, Oxford University Press, 2001. (TK2000.G981.2001)
- Chapman Stephen J, Electric Machinery and Power System Fundamentals, 5th Edition, McGraw-Hill, 2012. (TK2000.C466 2012)

Reference(s)
- Sen Paresh Chandra, Principles of Electric Machines and Power Electronics, 3rd Edition, John Wiley & Sons, 2014. (TK2000.S474p2014)

Course Code & Title	EE3011 – MODELLING AND CONTROL
Study Year	3
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Hu Guoqiang (Semester 1) ; Assoc Prof Soh Yeng Chai (Semester 2)
Learning Objective	Control Engineering plays a fundamental role in modern technological systems. The aim of this course is to serve as an introduction to control system analysis and design. The objectives include equipping students with: 1) Basic understanding of issues related to control systems such as modelling, time and frequency responses of dynamical systems, performance specifications and controller design; and 2) Skills and techniques for tackling practical control system design problems.
Course Contents	Introduction to Control Systems. System Modelling. Time Domain Analysis. Performance of Feedback Control Systems. Root-locus Technique. Frequency Domain Analysis. Relative Stability and Design Specifications. System Compensation and PID Control.
Prerequisite	EE2006 Engineering Mathematics I
Contact Hours	Lectures (26); Tutorials (12); Laboratories (3)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Practical Work Written Examination (60%)
Textbook(s)	• Ogata Katsuhiko, Modern Control Engineering, 5th Edition, Prentice-Hall, 2010. (TJ213.G34 2010)
Reference(s)	• Dorf Richard C and Bishop Robert H, Modern Control Systems, 12th Edition, Pearson Prentice Hall, 2011. (TJ216.D695 2011) • Kuo Benjamin C and Golnaraghi Farid, Automatic Control Systems, 9th Edition, John Wiley, 2010. (TJ213.K96 2010)

Course Code & Title	EE3012 – COMMUNICATION PRINCIPLES
Study Year	3
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Erry Gunawan
Learning Objective	This course is intended to introduce to the students: 1) The essential approaches, the fundamental concepts and the design issues that are involved in communication engineering. The course emphasises the understanding of engineering principles. 2) Basic concepts of modulation techniques including amplitude modulation (AM), frequency modulation (FM) and phase modulation (PM) that are widely used in analogue communication systems, and basic techniques for analysing such systems in the time and frequency domains. 3) Basic concepts of a digital communication system including sampling theorem, pulse code modulation (PCM) and principles of digital data transmission, and basic techniques for analysing such systems in the time and frequency domains.
Course Contents	Review of signal analysis and noise representations. Linear modulation. Frequency and phase modulation. Digital communication principles.
Prerequisite	EE2010 Signals and Systems
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24); Laboratories (3)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Participation; Practical Work Written Examination (60%)
Textbook(s)	• Couch Leon W, Digital and Analog Communication Systems, 8th Edition, Pearson, 2013. (TK5101.C853 2013)
Reference(s)	• Proakis John G and Salehi Masoud, Communication Systems Engineering, 2nd Edition, Prentice-Hall, 2002. (TK5101.P962 2002) • Lathi Bhagwandas Pannalal, Modern Digital and Analog Communication Systems, 4th Edition, Oxford University Press, 2009. (TK5101.L352 2009) • Haykin Simon S and Moher Michael, Communication Systems, 5th Edition, John Wiley, 2010. (TK5101.H419 2010)

Course Code & Title	EE3013 – SEMICONDUCTOR DEVICES AND PROCESSING

Study Year	3
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Ng Geok Ing (Semester 1) ; Assoc Prof Zhang Dao Hua (Semester 2)
Learning Objective	To provide students with the basic concepts of the engineering principles behind semiconductor processing, wafer fabrication and physical principles underlying the operation of basic semiconductor devices.
Course Contents	Fundamentals of Bipolar Devices. MOS Devices. Crystal growth and wafer preparation. Deposition Techniques. Diffusion and thermal oxidation. Ion implantation. Lithography. Etching.
Prerequisite	EE2003 Semiconductor Fundamentals
Contact Hours	Lectures (26); Tutorials (12); Laboratories (3)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Homework; Practical Quiz Written Examination (60%)
Textbook(s)	• Campbell Stephen A, Fabrication Engineering at the Micro- and Nanoscale, 4th Edition, Oxford University Press, 2013. (TK7871.85.C191F 2013)
Reference(s)	• Jaegar Richard C, Introduction to Microelectronic Fabrication: Vol 5 of Modular Series in Solid State Devices, 2nd Edition, Prentice-Hall, 2002. (TK7874.J22 2002) • Quirk Michael and Serda Julian, Semiconductor Manufacturing Technology, Prentice-Hall, 2001 (TK7836.Q93)

Course Code & Title	EE3014 – DIGITAL SIGNAL PROCESSING
Study Year	3
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Makur, Anamitra (Semester 1) ; Assoc Prof Marziliano, Pina (Semester 2)
Learning Objective	Digital signal processing (DSP) is concerned with the numerical manipulation of discrete signals/data. It has become an essential tool to many engineering and scientific areas, such as multimedia computing (for speech, audio, image, and video) and digital communications, for example. This course is designed to provide students the fundamentals of discrete-time signals, signal transforms, and digital filter design.
Course Contents	Introduction. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT). Z-Transform. Digital Filter Design.
Prerequisite	EE2010 Signals and Systems
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24); Laboratories (3)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Practical work Written Examination (60%)
Textbook(s)	• Oppenheim Alan V, Schafer Ronald W and Buck John R, Discrete-Time Signal Processing, 3rd Edition, Pearson Education, 2009. • Prandoni Paolo and Vetterli Martin, Signal Processing for Communication, 1st Edition, EPFL Press. (TK5102.9.P899) (Download here http://www.sp4comm.org/webversion.html)
Reference(s)	• Mitra Sanjit K, Digital Signal Processing: A Computer Based Approach, 4th Edition, McGraw-Hill, 2011. (TK5102.9.M684 2011)

Course Code & Title	EE3015 – POWER SYSTEMS AND PROTECTION
Study Year	3
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Wang Peng (Semester 1) ; Assoc Prof Gooi Hoay Beng (Semester 2)
Learning Objective	The learning objective of this course is to provide fundamental knowledge for B.Eng (EEE) students who wish to specialize in power engineering in their profession. It introduces the course participants to the overall structure of the electric power supply system, starting from power generation to power transmission and distribution. It includes basic concepts of power systems operation, fault analysis, and power systems protection techniques.
Course Contents	Fundamentals of Power Systems. Power Systems Operation and Analysis. Power Systems Fault Analysis. Over-current Protection of Distribution Systems. Differential Protection of Power Apparatus.
Prerequisite	EE2001 Circuit Analysis
Contact Hours	Lectures (26); Tutorial Sessions (12); Laboratories (3)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Practical work Written Examination (60%)

Textbook(s)	• Chapman Stephen J, Electric Machinery and Power System Fundamentals, 1st Edition, McGraw-Hill, 2002. (TK2000.C466E) • Blackburn J Lewis, Protective Relaying: Principles and Applications, 4th Edition, CRC Press, 2014. (TK2861.B628 2014)
Reference(s)	• Wildi Theodore, Electrical Machines, Drives and Power Systems, 6th Edition, Pearson/Prentice-Hall, 2006. (TK2182.W673 2006) • Weedy Birron Mathew and Cory Brian John, Electric Power Systems, 5th Edition, John Wiley, 2012. (TK1001.W394 2012) • Anderson Paul M, Power System Protection, McGraw-Hill, IEEE Press, 1999. (TK1010.A548)

Course Code & Title	EE3017 – COMPUTER COMMUNICATIONS
Study Year	3
Availability	Semester 1 ; Semester 2
Coordinator(s)	Dr Shao Xuguang, Michelle
Learning Objective	The course is intended to provide students with the fundamental concepts in computer communications, proceeding from data communications over a data link to transfer of information across local-area networks and wide-area networks.
Course Contents	Introduction to computer communications. Data Communications Fundamentals. Data Link Control. Local Area Networks. Internetworking.
Prerequisite	Nil
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24); Laboratories (3)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Individual Assignment; Participation Written Examination (60%)
Reference(s)	• Leon-Garcia Alberto and Widjaja Indra, Communication Networks: Fundamental Concepts and Key Architectures, 2nd Edition, McGraw-Hill, 2004. (TK5101.L579 2004) • Kurose James F and Ross Keith W, Computer Networking: A Top-Down Approach, 6th Edition, Pearson, 2013. (TK5105.875.I57K96 2013) • Stallings William, Data and Computer Communications, 10th Edition, Pearson/Prentice-Hall, 2014. (TK5105.S782 2014

Course Code & Title	EE3018 – INTRODUCTION TO PHOTONICS
Study Year	3
Availability	Semester 1
Coordinator(s)	Assoc Prof Wang Qijie
Learning Objective	This is an introductory course about the fundamentals of photonics and their impacts on our daily life. Photonics contributes to the fundamental platform for nanotechnology, green energy, home entertainment, data storage, sensing, imaging, biomedical healthcare, and modern optical communications. This course is intended for students with various engineering backgrounds (e.g. electrical, electronic, chemical, biological, mechanical, civil, aerospace, etc.) to learn the impact of photonics in fields ranging from nanotechnology to communications in a fundamental level rather than a mathematical-based formulated course.
Course Contents	Applications of Photonics and Nanophotonics. Fundamentals of Photonics. Propagation of Light. Optical Fibers. Photon and Laser Optics.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12); Laboratories (3)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quiz; Homework Assignment; Practical work Written Examination (60%)
Textbook(s)	• Eugene Hecht, Optics, 4th Edition, Addison-Wesley, 2002. (QC355.2.H447 2002) • Prasad Paras N, Nanophotonics, Wiley-Interscience, 2004. (TA1520.P911 2004) • Joseph C. Palais, Fiber Optic Communications, 5th Edition, Pearson/Prentice-Hall, 2005. (TK5103.59.P154 2005)
Reference(s)	• Smith Warren J, Modern Optical Engineering: The Design of Optical Systems, 4th Edition, McGraw-Hill, 2008. (TS513.S663 2008) • Kasap S O, Optoelectronics and Photonics: Principles and Practices, Prentice-Hall, 2001. (TK8304.K19) • Prasad Paras N, Introduction to Biophotonics, Wiley-Interscience, 2003. (QH515.P911)

Course Code & Title	EE3019 – INTEGRATED ELECTRONICS

Study Year	3
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Gwee Bah Hwee (Semester 1) ; Assoc Prof Kim Tae Hyoung (Semester 2)
Learning Objective	This course encompasses analog and digital electronic circuits from a circuit and monolithic (integrated circuit) implementation point of view. The objective of this course is to provide Year 3 electrical and electronic undergraduates with sufficient fundamental theoretical and practical knowledge to pursue advanced topics in analog and digital integrated circuits. The course includes the design of elements in bipolar- and CMOS-based op amps, feedback, power supplies, linear and non-linear applications circuits with the op amp as the basic building block, and transistor circuits for realising basic digital circuits. This course provides sufficient basic knowledge for the undergraduate to understand the design of op amps and their applications as well as the design of digital circuits.
Course Contents	Feedback amplifier. Voltage reference and current sources. Operational amplifier circuits. Applications of operational amplifiers. Power supplies. CMOS logic circuits. CMOS flip-flops and memories.
Prerequisite	EE2002 Analog Electronics
Contact Hours	Lectures (26); Tutorial Sessions (12); Laboratories (3)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Practical work Written Examination (60%)
Textbook(s)	• Sedra Adel S and Smith Kenneth Carless, Microelectronic Circuits, 6th Edition, Oxford University Press, 2010. (TK7867.S449 2010)
Reference(s)	• Kang Sung-Mo and Leblebici Yusuf, CMOS Digital Integrated Circuits: Analysis and Design, 4th Edition, McGraw-Hill, 2015. (TK7871.99.M44K16 2015) • Gray Paul R and Meyer Robert G, Analysis and Design of Analog Integrated Circuits, 5th Edition, John Wiley, 2010. (TK7874.G781 2010) • Franco Sergio, Design with Operational Amplifiers and Analog Integrated Circuits, 4th edition, McGraw-Hill, 2015. (TK7874.F825 2015)

Course Code & Title	EE3080 – DESIGN AND INNOVATIVE PROJECT
Study Year	3
Availability	Semester 1 ; Semester 2
Coordinator(s)	Prof Wen Changyun
Learning Objective	The main objectives of the Design and Innovative Project are to introduce students to electrical and electronic engineering projects, provide with students an opportunity to exercise their creative and innovative qualities in a group project environment and excite the imagination of aspiring engineers, innovators and technopreneurs.
Course Contents	Project Proposal, Lectures on Project Management, Project Implementation, Project Report, Oral Presentation, Design and Innovation Competition.
Prerequisite	Nil
Contact Hours	Lectures (6); Project Work (78)
Academic Units	2
Assessment Modes	Continuous Assessment (100%) – Assessments by Supervisor and Moderator

Course Code & Title	EE0040 – ENGINEERS AND SOCIETY
Study Year	4
Availability	Semester 1 ; Semester 2
Coordinator(s)	Dr Ng, Jessica
Learning Objective	To teach the social, economic, historical and political environment that the engineering profession operates in and the current issues relevant to them. The students also present and discuss these issues during tutorials and participate in community projects.
Course Contents	The course comprises 4 main topics: Evolution of Modern Singapore; Technology & Society; Ethics and Professionalism and The Environment. The students are made aware of "Current Issues" at the time of their study.
Prerequisite	Students must be in their final year of studies.
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)

Reference(s)	• Kwa Chong Guan, Derek Heng & Tan Tai Yong, Singapore: A Seven-Hundred Year History, (Singapore: National Heritage Board, National Archives of Singapore, 2009). • Singapore: Journey Into Nationhood, National Heritage Board: Landmark Books, 1998. (DS610.4.S617j) • Lee Kuan Yew, From Third World to First. The Singapore Story: 1965:2000, Memoirs of Lee Kuan Yew, Times Editions, 2000. (DS598.S7L478f) • Plagiarism 2.0 [videorecording]: Information Ethics in the Digital Age, Fabian and Rhonda. (PN167.P698 – BUSL) (H587897 – BUSLAVRES) • Jessica Lim, Editor, Engineering Ethics, Pearson South Asia Pte Ltd, 2016. • Fleddermann, Charles: Engineering Ethics, Pearson, 4th Edition, 2012. (TA157.F525)

Course Code & Title	EE4001 – SOFTWARE ENGINEERING
Study Year	4
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Chen Lihui
Learning Objective	The objective of this course is to provide students with an understanding of the essential software engineering body of knowledge.
Course Contents	Introduction to software engineering. Software project management. Software requirements and specifications. Software design. Software testing and maintenance.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments Written Examination (60%)
Reference(s)	• Sommerville Ian, Software Engineering, 9th Edition, Addison-Wesley, 2011. (QA76.758.S697 2011) • Pressman Roger S, Software Engineering: A Practitioner's Approach, 8th Edition, McGraw-Hill, 2014. • Pezze Mauro, and Young Michal, Software Testing and Analysis: Process, Principles and Techniques, Wiley, 2008. (QA76.76.T48P522) • Bob Hughes and Mike Cotterell, Software Project Management, 5th Edition, McGraw-Hill, 2009. • Pressman Roger S and Lowe David, Web Engineering: A Practitioner's Approach, McGraw-Hill, 2009. (TK5105.88813.P935)

Course Code & Title	EE4080 – FINAL YEAR PROJECT
Study Year	4
Availability	One-Year Course (Students can start their project either in Semester 1 or 2.)
Coordinator(s)	Assoc Prof Shen Zhongxiang
Learning Objective	The main objective of the Final Year Project is to provide a platform for students to demonstrate their ability to apply their knowledge and skills gained from coursework studies and practicum work. This course helps the students to gain confidence and experience in tackling project work independently which should contribute to their effective transition to the job market upon graduation.
Course Contents	Projects may include, but are not limited to, one or more of the following areas: Design, Product development, Software development, Laboratory investigation, Computing and analysis, Field testing and instrumentation and Feasibility studies. Besides project proposals generated by its own academic staff, the School also works with outside partners including the A*STAR Research Institutes and industrial companies to propose relevant projects. The requirements are specified under the scope and objective of each project. Students are allocated 9 hours per week for the project, spread over two semesters. Their time table includes 3 sessions per week, each session being 3 hours long. In practice, the students spend more time than this and may be allowed to use any free time slots.
Prerequisite	Refer to Final Year Project website
Contact Hours	Project Work (78)
Academic Units	8
Assessment Modes	Continuous Assessment (100%) - Project Assessments

Course Code & Title	EE4105 – CELLULAR COMMUNICATION SYSTEM DESIGN
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Soong Boon Hee

Learning Objective	This course aims to provide students with basic understanding of: 1) Principles involved in the design and implementation of mobile cellular systems; 2) Concepts and principles of digital signal processing techniques with emphasis on communication systems; and 3) DSP concepts through lab demonstrations and design examples by using a general purpose mathematical package such as MATLAB to design and simulate communication signal processing systems.
Course Contents	The students will be involved in the planning and design of cellular and wireless personal communication systems at the system level. Issues such as the choice of modulation and channel coding schemes as well as multiple access methods will be dealt with. Fundamentals of digital signal processing will be briefly introduced. DSP techniques used in the design of baseband digital signal transmission and reception will be covered. Carrier-modulated signals, such as AM, QAM and PSK signals, used for transmission through band-pass channels will be discussed. Channel equaliser design for compensation of channel distortions and inter-symbol interference (ISI) will be dealt with.
Prerequisite	Nil
Contact Hours	Lectures (13); Practical Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) – Assignments Written Examination (50%)
Reference(s)	• Karim M R and Saraf Moshen, W-CDMA and CDMA2000 for 3G Mobile Networks, McGraw Hill, 2002. (TK5103.452.K18) • Rappaport Theodore S, Wireless Communications: Principles and Practice, 2nd Edition, Prentice-Hall, 2002. (TK5103.2.R221 2002) • Proakis John G, Salehi Masoud and Bauch Gerhard, Modern Communication Systems Using MATLAB, 3rd Edition, Cengage Learning, 2013. (TK5105.P962m) • Proakis John G and Manolakis Dimitris G, Digital Signal Processing: Principles, Algorithms and Applications, 4th Edition, Pearson Prentice-Hall, 2007. (TK5102.9.P932) • D. Agrawal and Q. A. Zeng, An Introduction to Wireless and Mobile Systems, 4th Edition, Cengage Learning, 2016. (TK5103.2.A277 2016) • Harri Holma and Antti Toskala, LTE for UMTS: Evolution to LTE-Advanced, 2nd Edition, Wiley, 2011. (TK5103.4883.L925u)

Course Code & Title	EE4109 – WIRELESS SYSTEM DESIGN
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Lee Yee Hui
Learning Objective	This course will provide students with the basic understanding of the principles and hands-on experiences involved in the design and implementation of basic sub-systems of major types of wireless systems.
Course Contents	Students will be involved in the design of advanced receiver and transmitter sub-systems as well as radar system. It will include the analysis, design and simulation of these systems.
Prerequisite	Nil
Contact Hours	Lectures (13); Practical Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Reference(s)	• Pozar David M, Microwave and RF wireless systems, John Wiley, 2001. (TK5103.2.P893) • Skolnik, Merrill I, Introduction to Radar Systems, 3rd Edition, McGraw-Hill, 2001. (TK6575.S628 2001) • Razavi, Behzad, RF Microelectronics, 2nd Edition, Pearson Education, 2012. (TK6560.R278 2012) • Stimson, George W, Introduction to Airborne Radar, 3rd Edition, SciTech Publishing, 2014. (TL696.R2S859 2014)

Course Code & Title	EE4110 – OPTICAL COMMUNICATION SYSTEM DESIGN
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Shum Ping, Perry
Learning Objective	This course is intended to introduce to students an overview of optical fibre communication devices and systems, as well as hands-on experience of using professional tools for the design of optical fibre communications systems.
Course Contents	Students will be involved in the design of fiber optic communication systems. Issues such as light propagation, fiber characteristics and classification, fiber cables, connectors and splices, optical transmitters and receivers, optical amplifier and filter, optical coupler and wavelength converter, non-linear effects in WDM systems, and system design methodology are covered.

Prerequisite	Nil
Contact Hours	Lectures (13); Practical Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Textbook(s)	• Keiser Gerd, Optical Fiber Communications, 4th Edition, McGrw Hill, 2011. (TK5103.59.K27 2011)
Reference(s)	• Hecht Jeff, Understanding Fiber Optics, 5th Edition, Pearson/Prentice-Hall, 2006. (TA1800.H447 2006) • Powers John P, An Introduction to Fiber Optic Systems, 2nd Edition, Irwin, 1999. (TA1800.P888 1999) • Palais Joseph C, Fiber Optic Communications, 5th Edition, Pearson/Prentice-Hall, 2005. (TK5103.59.P154 2005) • Ramswami Rajiv and Sivarajan Kumar N, Optical Networks: A Practical Perspective, 3rd Edition, Morgan Kaufmann 2008.

Course Code & Title	EE4152 – DIGITAL COMMUNICATIONS
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Li Kwok Hung
Learning Objective	The aim is to provide students with a good understanding of digital communications principles and digital techniques required in the rapidly expanding field of digital signal transmission and modulation in communication systems.
Course Contents	Digital communication principles. Information theory. Error correcting codes. Optimum signal detection.
Prerequisite	EE3012 Communication Principles
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Homework Assignment; Project Report Written Examination (60%)
Textbook(s)	• B P Lathi and Z. Ding, Modern Digital and Analog Communication Systems, 4th Edition, Oxford University Press, 2009. (TK5101.L352 2009)
Reference(s)	• S. Haykin and K. Moher, Communication Systems, 5th Edition, John Wiley, 2010. (TK5101.H419 2010) • J. G. Proakis and M. Salehi, Communication Systems Engineering, 2nd Edition, Prentice-Hall, 2002. (TK5101.P962 2002)

Course Code & Title	EE4153 – TELELCOMMUNICATION SYSTEMS
Study Year	4
Availability	Semester 2
Coordinator(s)	Prof Zhong Wende
Learning Objective	To provide the students with the basic understanding of the principles involved in the design and implementation of optical fibre communication systems, transmission principles, LOS and satellite communication systems, public switched telephone networks, teletraffic theory, digital transmission system standards (PDH and SDH), network planning and principle of digital switching systems.
Course Contents	Telecommunication Networks. Switching and Signalling. Line Transmission. Microwave Communication Systems. Optical Fibre Communication Systems and Applications.
Prerequisite	EE3012 Communication Principles
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Homework Assignments Written Examination (60%)
Textbook(s)	• Flood John Edward, Telecommunications Switching, Traffic and Networks, Prentice-Hall, 1995. (reprinted 1999). (TK5103.F631) • Tomasi Wayne, Electronic Communications System: Fundamentals Through Advanced, 5th Edition, Pearson Prentice-Hall, 2004. (TK5101.T655E 2004)
Reference(s)	• Keiser Gerd, Optical Fiber Communications, 4th Edition, McGraw Hill, 2011. (TK5103.59.K27 2011) • Beasley Jeffrey S and Miller Gray M, Modern Electronic Communication, 9th Edition, Pearson/Prentice-Hall, 2008. (TK5101.M648 2008) • Roger L. Freeman, Telecommunication System Engineering, 4th Edition, Wiley-Interscience, 2004, TK5103.F855 2004. (also e-book)

Course Code & Title	EE4188 – WIRELESS COMMUNICATIONS

Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Soong Boon Hee
Learning Objective	This course is intended to introduce to students: 1) The basics of wireless systems – concepts, theory, limitation and costs of systems mainly for VHF and above. 2) Various multiple access techniques and the cellular concept as well as some 2G and 3G systems.
Course Contents	Types of wireless systems. Radio frequency spectrum. Performance calculations. Cellular radio systems.
Prerequisite	EE3012 Communication Principles
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Homework Assignment; Class Participation Written Examination (60%)
Textbook(s)	• Agrawal Dharma Prakash and Zeng Qing-An, Introduction to Wireless and Mobile Systems, 4th Edition, Cengage Learning, 2016. (TK5103.2.A277 2016) • Beard Cory and William Stallings, Wireless Communications Networks and Systems, Prentice Hall, 2015.
Reference(s)	• Freeman Roger L, Radio System Design for Telecommunications, 3rd Edition, IEEE/Wiley-Interscience, 2007. (TK6553.F855 2007) • Simon R. Saunders, and Alejandro Aragon-Zavala, Antennas and Propagation for Wireless Communication Systems, 2nd Edition, John Wiley, 2007. (TK7871.6.S257 2007) • Rappaport Theodore S, Wireless Communications: Principles and Practice, 2nd Edition, Prentice-Hall, 2002. (TK5103.2.R221 2002) • Andreas F. Molisch, Wireless Communications, 2nd Edition, John Wiley & Sons, 2011. (TK5103.2.M724 2011)

Course Code & Title	EE4190 – INTRODUCTION TO MODERN RADAR
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Ng Boon Poh
Learning Objective	To give students an understanding of the practical aspects involved in complex system-level engineering solutions using modern radars as the basis. This introduction to modern radar will tie many topics they have learnt as separate modules into a real-world system: Antenna theory, Electromagnetic propagation and scattering, RF design, Digital circuits & systems, Signal processing, and Information processing.
Course Contents	Introduction. Detection, Clutter, Matched Filtering & Doppler. Hardware Considerations & Electromagnetic Propagation. Synthetic Aperture Radar. Software Defined Radar (SDR) Concept and Demonstration. Array Beamforming and Space-time Adaptive Processing. Introduction to Target Tracking and Tracking Algorithms. Radar Variants and Trends.
Prerequisite	EE2010 Signals and Systems
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments Written Examination (60%)
Textbook(s)	• Stimson George W, Hugh Griffiths, Christopher Baker and Dave Adamy, Stimson's Introduction to Airborne Radar, 3rd Edition, SciTech Publishing, 2014. (TL696.R2S859 1998)
Reference(s)	• Richards Mark A, Principles of Modern Radar: Basic Principles, SciTech Publishing, 2010. (TK6575.P957 V1) • Mahafza Bassem R, Radar Signal Analysis and Processing Using MATLAB, CRC Press, 2009. (TK6575.M214RS) • Wirth W, Radar Techniques Using Array Antennas, 2nd Edition, IEE, 2013. • Skolnik Merrill, Introduction to Radar Systems, 3rd Edition, McGraw-Hill, 2001. (TK6575.S628 2001) • Carrara Walter G, Goodman Ron S and Majewski Ronald M, Spotlight Synthetic Aperture Radar: Signal Processing Algorithms, Artech House, 1995. (TK6592.S95C313)

Course Code & Title	EE4207 – CONTROL ENGINEERING DESIGN
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Chan Chok You, John
Learning Objective	There are two main objectives: (1) To apply control engineering knowledge to dc-dc power converter control and to design and build different types of controllers to meet the design specifications; (2) To design and implement a microcontroller-based control system.

Course Contents	This course introduces the basics of a regulated dc power supply and a microcontroller-based control system.
Prerequisite	Nil
Contact Hours	Lectures (13); Practical Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) – Practical Written Examination (50%)
Reference(s)	• Maciejowski Jan Marian, Predictive Control with Constraints, Prentice-Hall, 2002. (TJ217.6.M152) • Gopal M, Digital Control and State Variable Methods: Conventional and Neural-Fuzzy Control Systems, 3rd Edition, TaTa-McGraw Hill, 2009. (TJ223.M53G659D 2008).

Course Code & Title	EE4208 – INTELLIGENT SYSTEM DESIGN
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Wang Han
Learning Objective	In recent years, computational intelligence methods like artificial neural networks, fuzzy systems, genetic algorithms and computer vision have been extensively applied in the design of intelligent control and automation systems such as autonomous vehicles, visual inspection of industrial products, automated analysis and screening of volumes of medical images. The objective of this design module is to provide students an opportunity to study some selected aspects of computational intelligence methods in-depth and to develop and test intelligent automation systems. In particular, this subject will focus on aspects of intelligent systems designed using computer vision.
Course Contents	This module covers the design of intelligent systems such as intelligent automation systems, neuro-fuzzy systems and intelligent vision systems. Currently, the focus is on the design of computer vision systems.
Prerequisite	Nil
Contact Hours	Lectures (13); Practical Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Reference(s)	• Haralick Robert M and Shapiro Linda G, Computer and Robot Vision, Addison-Wesley, 1993. (TA1632.H254)

Course Code & Title	EE4265 – PROCESS CONTROL SYSTEMS
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Cai Wenjian
Learning Objective	Process control system is a widely applied technology in the continuous and batch processes in the manufacturing field. The purpose of the subject is to serve as an introduction to the analysis and design of such control systems. Specifically, the subject aims to equip the students with (a) a basic understanding of the practical issues related to the control of industrial processes (b) the modelling, analysis and design techniques applicable to these control systems and (c) an awareness of the advanced control techniques that could be applied to such processes.
Course Contents	Introduction. Process Models. Feedback Control Systems. Complex Control Structures. Feedback Controller Design for Time Delay Systems. Advanced Control Techniques. Process Control Applications.
Prerequisite	EE3011 Modelling and Control
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	• Continuous Assessment (40%) – Quizzes; Assignments; Class Participation • Written Examination (60%)
Textbook(s)	• Seborg Dale E, Edgar Thomas F and Mellichamp Duncan A, Process Dynamics and Control, 3rd Edition, Wiley, 2011. (TP155.75.S443 2011)
Reference(s)	• Ogunnaike Babatunde A and Ray W Harmon, Process Dynamics, Modeling and Control, Oxford University Press, 1994. (TP155.75.G35) • Luyben Michael L and Luyben William L, Essentials of Process Control, McGraw-Hill, 1997. (TP155.75.L978) • Shinskey F Greg, Process Control Systems: Application, Design and Tuning, 4th Edition, McGraw-Hill, 1996. (TP155.75.S556 1996)

Course Code & Title	EE4266 – COMPUTER VISION
Study Year	4
Availability	Semester 1

Coordinator(s)	Assoc Prof Wang Han
Learning Objective	Computer Vision and Image Processing play very important roles in fields such as Machine and Robot Intelligence. They provide the means for the machine or robot to interact intelligently with the outside world through visual perception. Vision is undoubtedly the most powerful of all senses and enables robots to perform very flexible tasks such as moving around autonomously in a factory floor or outdoors. The applications are plentiful and very challenging. Face recognition, human activity interpretations, human-computer interaction, quality inspection of mass-produced parts, robot/missile/vehicle guidance, medical imaging and computer vision-aided surgery are some of the applications. The objective of this course is to prepare students for working in such intelligent automation fields.
Course Contents	Image Representation. Preprocessing Techniques. Segmentation and Representation. Recognition and Machine Intelligence. Machine Vision Applications.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments; Class Participation Written Examination (60%)
Textbook(s)	• Gonzalez Rafael C, Digital Image Processing, 3rd Edition, Prentice-Hall, 2008. (TA1632.G643 2008)
Reference(s)	• Awcock G J and Thomas Ray, Applied Image Processing, McGraw-Hill, 1996. (TA1637.A965) • Duda Richard O, Hart Peter E and Stork David G, Pattern Classification, 2nd Edition, John Wiley, 2001. (Q327.D844 2001)

Course Code & Title	EE4268 – ROBOTICS AND AUTOMATION
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Cheah Chien Chern
Learning Objective	This course introduces fundamental concepts in robotics. The objective of the course is to provide an introductory understanding of robotics. Students will be exposed to a broad range of topics in robotics with emphasis on basics of manipulators, coordinate transformation and kinematics, trajectory planning, control techniques, sensors and devices, robot applications and economics analysis.
Course Contents	Introduction to Robotics. Coordinate Transformation and Kinematics. Trajectory Planning. Control Techniques. Sensors and Devices. Robot Applications.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Group Project Written Examination (60%)
Textbook(s)	• Craig John J, Introduction to Robotics: Mechanics and Control, 3rd Edition, Prentice-Hall, 2005. (TJ211.C886 2005)
Reference(s)	• Schilling Robert J, Fundamentals of Robotics: Analysis and Control, Prentice-Hall, 1990. (TJ211.S334) • Niku Saeed B, An Introduction to Robotics Analysis, Systems, Applications, Prentice-Hall, 2001. (TJ211.N694)

Course Code & Title	EE4273 – DIGITAL CONTROL SYSTEMS
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Hu Guoqiang
Learning Objective	Digital controllers are used in a wide variety of systems ranging from disk drives to aircrafts. Thus, it is very important to be well-versed in the analysis and design of digital control systems. The course objectives include equipping students with the knowledge of: 1) Various issues related to digital control systems such as effects of sampling and quantization, discrete time signals and models; 2) Design and implementation of digital controllers, implementation issues such as saturation and quantization arising from practical digital controllers.
Course Contents	Signal conversion and reconstruction. Analysis and design of digital control systems. State variable techniques and implementation issues.
Prerequisite	EE3011 Modelling and Control
Contact Hours	Lectures (26); Tutorial Sessions (12); Laboratories (3)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Homework Assignments; Laboratory Written Examination (60%)
Textbook(s)	• Ogata Katsuhiko, Discrete-Time Control Systems, 2nd Edition, Prentice-Hall, 1995. (QA402.G34 1995)

Reference(s)
- Franklin Gene F, Powell J David and Workman Michael L, Digital Control of Dynamic Systems, 3rd Edition, Addison-Wesley, 1998. (TJ223.M53F831 1998)
- Astrom Karl Johan and Wittenmark Bjorn, Computer-Controlled Systems: Theory and Design, 3rd Edition, Prentice-Hall, 1997. (TJ213.A859 1997)
- Phillips Charles L and Nagle H Troy, Digital Control System Analysis and Design, 4th Edition, Prentice-Hall, 2015. (TJ223.M53P558 2015)
- Gopal M, Digital Control and State Variable Methods: Conventional and Neural-Fuzzy Control Systems, 3rd Edition, Tata-McGraw Hill, 2008. (TJ223.M53G659D 2008)

Course Code & Title	EE4285 – COMPUTATIONAL INTELLIGENCE
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Su Rong
Learning Objective	This course aims at introducing the fundamental theory and concepts of computational intelligence methods, in particular neural networks, fuzzy systems, genetic algorithms and their applications in the area of machine intelligence. This can be summarized as: 1) To understand the fundamental theory and concepts of neural networks, neuro-modeling, several neural network paradigms and its applications. 2) To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic. 3) To understand the basics of an evolutionary computing paradigm known as genetic algorithms and its application to engineering optimization problems.
Course Contents	Introduction. Fundamental Concepts and Models of Artificial Neural Systems. Neural Network Learning Paradigms and Architectures. Applications of Artificial Neural Networks. Fuzzy Sets. Fuzzy Inference Mechanisms, Applications of Fuzzy Logic. Genetic Algorithms and its Applications in Optimization.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Homework Assignment; Class Participation Written Examination (60%)
Textbook(s)	• Buckley, James J and Eslami, Esfandiar, An introduction to fuzzy logic and fuzzy sets, Physica-Verlag, 2002. (QA76.9.S63B924) • Zurada Jacek M, Introduction to Artificial Neural Systems, West, 1992. (QA76.87.Z96) • Back Thomas, Evolutionary Algorithms in Theory and Practice: Evolution Strategies, Evolutionary Programming, Genetic Algorithms, Oxford University Press, 1996. (QA402.5.B365)
Reference(s)	• Terano Toshiro, Asai Kiyoji and Sugeno Michio, Fuzzy Systems Theory and its Applications, Academic Press, 1992. (QA248.T315) • Lin Ching Tai and Lee C S George, Neural Fuzzy Systems: A Neuro-Fuzzy Synergism to Intelligent Systems, Prentice-Hall, 1996. (TJ217.25.L735)

Course Code & Title	EE4303 – MIXED-SIGNAL IC DESIGN
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Lam Ying Hung, Yvonne
Learning Objective	The objective of this course is to introduce circuit design concepts for basic building blocks used in mixed-signal integrated circuit designs. The course will provide students with the skills to design mixed-signal integrated circuits with these building blocks.
Course Contents	This design course is based on the use of standard fabrication technologies (e.g., CMOS and BiCMOS) to realize analog and digital functions on integrated circuits. Students learn practical circuit design techniques as well as device characteristics and the theory of circuit synthesis and analysis. A mixed-signal circuit design project of medium complexity is included to enhance student′ s learning.
Prerequisite	EE3019 Integrated Electronics
Contact Hours	Design Sessions (39)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Textbook(s)	• Baker R Jacob, CMOS: Circuit Design, Layout, and Simulation, 3rd Edition, IEEE Press/Wiley, 2010. (TK7871.99.M44B168 2010)
Reference(s)	• Sansen Wiley M C, Analog Design Essentials, Springer, 2006. (TK7874.654.S229)

- Gray Paul R, Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley, 2009. (TK7874.G781 2009)

Course Code & Title	EE4304 – RADIO FREQUENCY INTEGRATED SYSTEM DESIGN
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Zhang Yue Ping
Learning Objective	The objective of this course is to introduce the theory and concept of radio frequency integrated system. Students will learn to analyze the performance parameters of radio frequency circuits and identify design trade-off of radio frequency communication systems. Students will perform practical design and simulation exercises using the electronic design automation tools to enhance their understanding of the design problems encountered in CMOS RF integrated circuits.
Course Contents	RF Integrated Systems, Design and Simulation of RF Circuits.
Prerequisite	EE3019 Integrated Electronics
Contact Hours	Design Sessions (39)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Textbook(s)	• Razavi Behzad, RF Microelectronics, 2nd Edition, Pearson Education, 2012. (TK6560.R278 2012)
Reference(s)	• Yeo Kiat Seng, Do Manh Anh and Boon Chirn Chye, Design of CMOS RF Integrated Circuits and Systems, World Scientific, 2010. (TK7874.78.Y46) • Couch Leon W, Digital and Analog Communication Systems, 8th Edition, Pearson/Prentice-Hall, c2013. (TK5101.C853 2013) • Razavi Behzad, Design of Analog CMOS Integrated Circuits, McGraw-Hill, 2001. (TK7874.654.R278)

Course Code & Title	EE4305 – DIGITAL DESIGN WITH HDL
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Ho Duan Juat
Learning Objective	The objective of this course is to introduce a hardware description language (HDL) for the specification, simulation, synthesis and implementation of digital logic systems. The students will have design practice sessions designing and implementing digital logic systems with commercial electronic design automation (EDA) tools.
Course Contents	Digital Design using Hardware Description Language. Design Practice.
Prerequisite	EE2004 Digital Electronics
Contact Hours	Design Sessions (39)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Textbook(s)	• Yalamanchili Sudhakar, VHDL: A Starter's Guide, 2nd Edition, Pearson/Prentice Hall, 2005. (TK7885.7.Y16 2005)
Reference(s)	• Chu Pong P, RTL hardware design using VHDL: Coding for Efficiency, Portability and Scalability, John Wiley, 2006. (TK7868.D5C559) • Chu Pong, P, FPGA Protyping by VHDL Examples, John Wiley, 2008. (TK7895.G36C485) • Roth, Charles H and John Lizy Kurian, Digital Systems Design using VHDL, 2nd Edition, Thomson, 2008. (TK7888.4.R845D 2008)

Course Code & Title	EE4340 – VLSI SYSTEMS
Study Year	4
Availability	Semester 1
Coordinator(s)	Dr Ong Keng Sian, Vincent
Learning Objective	The objective of this course is to provide students with a sound knowledge of VLSI systems covering the following: 1) Processor architectures, memory organization and performance analysis, and concepts and techniques for parallel processing and pipeline processing. 2) High-speed synchronization design and system noise consideration. 3) VLSI system design verification and testability, and system reliability. The emphasis of the course is on techniques for system design, testing, system noise and performance analysis. It serves as an introductory course to other more advanced and specialized VLSI system design courses at the postgraduate level.

Course Contents	VLSI System Architecture and Memory Management. Parallel Processing. High Speed Synchronous and Asynchronous design. System noise consideration. VLSI system verification and testability. System reliability.
Prerequisite	EE2004 Digital Electronics
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quiz; Written Assignment; Class Participation Written Examination (60%)
Textbook(s)	• Dally William J and Poulton John W, Digital Systems Engineering, Cambridge University Press, 1998. (TK7888.3.D147)
Reference(s)	• Hayes John Patrick, Computer Architecture and Organization, 3rd Edition, McGraw-Hill, 1998. (QA76.9.A73H417 1998) • Mano M Morris and Kime Charles R, Logic and Computer Design Fundamentals, 4th Edition, Pearson/Prentice-Hall, 2008. (TK7888.4.M285 2008) • Stallings William, Computer Organization and Architecture: Designing for Performance, 9th Edition, Prentice-Hall, 2013. (QA76.9.C643S782 2013) • Rabaey Jan M, Chandrakasan Anantha and Borivoje Nikolic, Digital Integrated Circuits: A Design Perspective, 2nd Edition, Pearson Education, 2003. (TK7874.65.R112 2003) • Wolf Wayne, Modern VLSI Design: IP-based design, 4th Edition, Prentice Hall, 2009. (TK7874.65.W855M) • Lin Ming-Bo, Introduction to VLSI Systems: A Logic, Circuit, and System Perspective, CRC Press, 2012.

Course Code & Title	EE4341 – ADVANCED ANALOG CIRCUITS
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof See Kye Yak
Learning Objective	The main objective is to familiarize students with the design methodologies of analog circuits and subsystems that are constructed using bipolar and MOS transistors. This subject is organized into five commonly used analog circuits: wide-bandwidth amplifiers, low noise amplifiers, power amplifiers, DC-DC converters and active filters. These analog circuits will be described in terms of their individual functional blocks consisting of transistors and other electronic components.
Course Contents	Wide-bandwidth amplifiers. Low noise circuits. Power amplifiers. DC-DC converters. Active filters.
Prerequisite	EE3019 Integrated Electronics
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Home Assignments Written Examination (60%)
Textbook(s)	• Franco Sergio, Design with Operational Amplifiers and Analog Integrated Circuits, 4th edition, McGraw-Hill, 2015. (TK7874.F825 2015)
Reference(s)	• Gray Paul R, Analysis and Design of Analog Integrated Circuits, 5th Edition, John Wiley, 2010. • Tony Chan Carusone, Analog Integrated Circuits Design, 2nd Edition, John Wiley, 2011.

Course Code & Title	EE4343 – RADIO FREQUENCY CIRCUITS
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Boon Chirn Chye
Learning Objective	The objectives of this course is to provide students with RF circuit fundamentals for designing various circuit building blocks in a typical RF transceiver.
Course Contents	Radio-frequency input-circuits and impedance matching. Small-signal radio-frequency amplifiers. Mixers. RF Power Amplifiers. Oscillators. Phase-Locked Loop circuits.
Prerequisite	EE3019 Integrated Electronics
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Class Participation Written Examination (60%)
Textbook(s)	• Ludwig Reinhold and Bretchko Pavel, RF Circuit Design: Theory and Applications, 2nd Edition, Prentice-Hall, 2008.
Reference(s)	• Smith Jack R, Modern Communication Circuits, 2nd Edition, McGraw-Hill, 1998. (TK6553.S651 1998)

- White Joseph F, High Frequency Techniques: An Introduction to RF and Microwave Engineering, IEEE Press, 2004. (TK7876.W585H)
- Wolaver Dan H, Phase-Locked Loop Circuit Design, Prentice-Hall, 1991. (TK7872.P38W848)

Course Code & Title	EE4344 – ANALYSIS AND DESIGN OF INTEGRATED CIRCUITS
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Chan Pak Kwong
Learning Objective	The course offers important topics for analog, digital and mixed-signal integrated circuits. It covers circuit operation, circuit analysis, design techniques and methodologies, implementation approaches, low-voltage low-power CMOS/BiCMOS circuit design, and key building blocks for integrated circuit designs.
Course Contents	Basic Analog Building Blocks. Data Converters. Low-Voltage Low-Power Digital Circuits. Memories. Sequential and Self-Timed CMOS Circuits. Design Methodologies and Implementation Strategies.
Prerequisite	EE3019 Integrated Electronics
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Design Proposal Written Examination (60%)
Textbook(s)	• Allen Phillip E and Holberg Douglas R, CMOS Analog Circuit Design, 3rd Edition, Oxford University Press, 2012. (TK7874.A428 2012) • Weste Neil H E and Harris David Money, CMOS VLSI Design: A Circuit and Systems Perspective, 4th Edition, Addison Wesley, 2011. (TK7874.W525 2011)
Reference(s)	• Rabaey Jan M, Chandrakasan Anantha P and Nikolic Borivoje, Digital Integrated Circuits: A Design Perspective, 2nd Edition, Pearson Education, 2003. (TK7874.65.R112 2003) • Lin Ming-Bo, Introduction to VLSI Systems: A Logic, Circuit and System Perspective, CRC Press, 2012. (TK7874.75.L735) • Sansen Wiley M C, Analog Design Essentials, Springer, 2006. (TK7874.654.S229) • Johns David A and Ken Martins, Analog Integrated Circuit Design, 2nd Edition, John Wiley & Sons, 2013. (TK7874.J65 2013)

Course Code & Title	EE4413 – DSP SYSTEM DESIGN
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Ng Boon Poh
Learning Objective	1. To understand the key theoretical principles underpinning DSP in a design procedure through design examples and case studies. 2. To learn how to use a powerful general-purpose mathematical package such as MATLAB to design and simulate a DSP systems. 3. To understand the architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation. 4. To learn to design a real-time signal processing algorithms using the latest fixed-point processor.
Course Contents	This subject introduces the basic rules, procedures, techniques and components for designing a DSP system. The subject also includes an assignment for the students to apply the knowledge and techniques learnt. DSP Architectures, Addressing Mode, DSP fixed-point programming style, real-time implementation issues, DSP integrated development environment.
Prerequisite	Nil
Contact Hours	Lectures (13); Design Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) – Designs; Assignments Written Examination (50%)
Reference(s)	• Mitra, Sanjit K, Digital Signal Processing: A Computer Based Approach, 4th Edition, McGraw-Hill, 2011. (TK5102.9.M684 2011) • Proakis John G and Manolakis Dimitris G, Digital Signal Processing: Principles, Algorithms and Applications, 4th Edition, Prentice-Hall, 2006. • Kuo Sen M, Lee Bob H and Tian Wenshun, Real-Time Digital Signal Processing: Fundamentals, implementations and applications, 3rd edition, John Wiley, 2013. (TK5102.9.K96R 2013) • Oppenheim Alan V, Schafer Ronald W, and Buck John R, Discrete-Time Signal Processing, 3rd Edition, Prentice-Hall, 2009.

- T.B. Welsh, H.G. Cameron and M.G. Morrow, Real-Time Digital Signal Processing from MATLAB to C with the TMS320C6x DSPs, Second Edition, Taylor and Francis, 2011.

Course Code & Title	EE4455 – EMBEDDED SYSTEMS
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Gan Woon Seng
Learning Objective	This course is structured to combine lectures, insightful demonstrations, case studies and tutorials for the students to gain an in-depth understanding of fundamental concepts on embedded systems. Several portable embedded media applications such as MP3 player, digital camera and digital video streaming will be showcased to tie the basic concepts together into coherent entities.
Course Contents	Introduction to Embedded System and Embedded Processors. Hardware of embedded systems. Software of embedded systems. Real-Time Embedded System. Embedded Media Processing Components Design. Standards.
Prerequisite	EE3002 Microprocessors
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quiz; Assignment; Class Participation Written Examination (60%)
Textbook(s)	• Marilyn Wolf, Computers as Components: Principles of Embedded Computing System Design, 3rd Edition, Morgan Kaufmann, 2012. (QA76.9.S88W855 2012) • Gan Woon-Seng and Kuo Sen M, Embedded Signal Processing with the Micro Signal Architecture, Wiley-Interscience, 2007. (TK5102.9.G195)
Reference(s)	• Katz David J and Gentile Rick, Embedded Media Processing, Elsevier/Newnes, 2006. (TK5102.9.K19) • Noergaard Tammy, Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers, 2nd Edition, Elsevier/Newnes, 2013. (TK7895.E42N769 2013) • Wolf Wayne Hendrix, Computers as Components: Principles of Embedded Computing System Design, 3rd Edition, Morgan Kaufmann, 2012. (QA76.9.S88W855 2012) • Kuo Sen M and Gan Woon-Seng, Digital Signal Processors: Architectures, Implementations and Applications, Pearson Prentice Hall, 2005. (TK5102.9.K96) • High Performance EMbedded Computing: 2nd Ed by Marilyn Wolf, Publisher: Morgan Kaufman, 2014.

Course Code & Title	EE4475 – AUDIO SIGNAL PROCESSING
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Bi Guoan
Learning Objective	The objective of this "Audio Signal Processing" course is to provide students with fundamental knowledge about various signal processing techniques applied to digital audio signals. All of these are essential to the understanding of the function of present day digital audio processing systems and form a strong foundation of the learning of newly developed digital devices/systems with applications to audio signals. Thus this course serves as an introductory course to other more advanced digital audio signal processing.
Course Contents	Fundamentals of Human Hearing. Room Acoustics. 3-D Sound Synthesis. Sound Compression.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments; Class Participation Written Examination (60%)
Textbook(s)	1. Bosi Marina and Goldberg Richard E, Introduction to Digital Audio Coding and Standards, Kluwer Academic, 2003. (TK7881.4.B743) 2. Kuo Sen M and Gan Woon-Seng, Digital Signal Processors: Architectures, Implementations and Applications, Pearson Prentice-Hall, 2005. (TK5102.9.K96) • Gardner William G, 3-D Audio Using Loudspeakers, Kluwer Academic, 1998. (TK7881.83.G228)
Reference(s)	1. Pohlmann Ken C, Principles of Digital Audio, 6th Edition, McGraw-Hill, 2011. (TK7881.4.P748 2011) • Watkinson John, The Art of Digital Audio, 3rd Edition, Focal Press, 2001. (TK7881.4.W336 2001)

Course Code & Title	EE4476 – IMAGE PROCESSING
Study Year	4

Availability	Semester 1
Coordinator(s)	Assoc Prof Tan Yap Peng
Learning Objective	This course is an introduction to the fundamental concepts and techniques in basic digital image processing and their applications to solve real life problems. The topics covered include Digital Image Fundamentals, Image Transforms, Image Enhancement, Restoration and Compression, and Nonlinear Image Processing. Application examples are also included.
Course Contents	Digital Image Fundamentals. Image Transforms. Image Enhancement. Image Restoration. Image Compression. Nonlinear Image Processing. Applications.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quiz; Assignment; Project Written Examination (60%)
Textbook(s)	• Gonzalez Rafael C and Woods Richard E, Digital Image Processing, 3rd Edition, Prentice Hall, 2008. (TA1632.G643 2008)
Reference(s)	• Pratt William K, Digital Image Processing: PIKS Scientific Inside, 4th Edition, John Wiley, 2007. (TA1632.P917 2007) • Pitas Ioannis, Digital Image Processing Algorithms and Applications, John Wiley, 2000. (TA1637.P681) • Jain Anil K, Fundamentals of Digital Image Processing, Prentice-Hall, 1989. (TA1632.J25)

Course Code & Title	EE4478 – DIGITAL VIDEO PROCESSING
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Chau Lap Pui
Learning Objective	This course aims to introduce digital video processing with an emphasis on video coding and its international standards, since coding is a turnkey technology of today′ s multimedia applications. Students will learn how video processing technologies are exploited in various multimedia applications.
Course Contents	Fundamentals of Digital Video. Block - matching motion estimation and fast algorithms. Video coding basics. Video coding standards. Video streaming and processing. Digital video applications.
Prerequisite	Nil
Contact Hours	Video lectures (26), Interactive Tutorial Sessions (14); Practical (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quiz; Assignment; Practical Written Examination (60%)
Textbook(s)	• Shi Yun Q and Sun Huifang, Image and Video Compression for Multimedia Engineering: Fundamentals, Algorithms, and Standards, 2nd Edition, CRC Press, 2008. (QA76.575.S555 2008) • Wang Yao, Ostermann Jeorn and Zhang Ya-Qin, Video Processing and Communications. Prentice Hall, 2002. (TK5105.2.W246)
Reference(s)	• Symes Peter, Digital Video Compression, McGraw-Hill, 2004. (TK6680.5.S986D) • Schaar Mihaela van der, Turaga Deepak S and Stockhammer Thomas, MPEG-4 Beyond Conventional Video Coding: Object Coding, Resilience, and Scalability, 1st Edition, Morgan & Claypool, 2006. (TK6680.5.S291) • Richardson Iain E G, The H.264 Advanced Compression: Standard, 2nd Edition, Wiley, 2010. (TK6680.5.R522 2010) • Tekalp A Murat, Digital Video Processing, Prentice-Hall, 1995. (TK6680.5.T266) • ISO/IEC 11172-2, Information Technology - Coding of Moving Pictures and Associated Audio for Digital Storage Media at up to about 1.5 Mbit/s, Part 2: Video, BSI, 1995. (QC100.B862 BS EN ISO/IEC 11172-2 1995) • ISO/IEC IS 13818-2, Information Technology - Generic Coding of Moving Pictures and Associated Audio Information: Video, 1995. (TK277.I85 ISO/IEC13818-2 1996(E)) • ISO/IEC IS 14496, Information Technology - Coding of Audio-Visual Objects - Part 2: Visual, Geneva, 1999. (TK277.I85 ISO/IEC14496-2(E))

Course Code & Title	EE4483 – ARTIFICIAL INTELLIGENCE & DATA MINING
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Chen Lihui
Learning Objective	The course is designed to introduce both (1) The traditional approach to machine learning using symbolic representations and manipulations, i.e., knowledge representations and problem solving techniques, and (2) Techniques and application of machine learning techniques to data mining.
Course Contents	Problem solving techniques. Machine learning and applications to data mining.

Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quiz; Assignment; Projects Written Examination (60%)
Textbook(s)	• Luger George F, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, 6th Edition, Addison-Wesley, 2009. (Q335.L951) • Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining: Pearson New International Edition, 2013.
Reference(s)	• Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann, 2011, ISBN: 978-0-12-381479-1. • S. Russell and P. Norvig, Artificial Intelligence A Modern Approach, 3rd Edition, Prentice Hall, 2010. (Q335.R967A 2010)

Course Code & Title	EE4490 – MULTIMEDIA SYSTEMS
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Ma Kai-Kuang
Learning Objective	The objective of this course is to provide students with a basic understanding of multimedia systems. This course focuses on topics in multimedia information representation and relevant signal processing aspects, multimedia networking and communications, and multimedia standards especially on the audio, image and video compression. All of these topics are important in multimedia industries.
Course Contents	Fundamentals of Multimedia Systems. Overview of Digital Image and Video Coding Standards. Overview of Digital Audio Coding Standard. Multimedia Communications. Multimedia Applications.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Project Written Examination (60%)
Textbook(s)	• Li Ze-Nian and Drew Mark S, Fundamentals of Multimedia, 2nd Edition, Pearson Prentice-Hall, 2014.
Reference(s)	• Steinmetz Ralf and Nahrstedt Klara, Multimedia: Computing, Communications and Applications, Prentice-Hall, 1997. (QA76.575.S823 1997)

Course Code & Title	EE4503 – POWER ENGINEERING DESIGN
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof So Ping Lam
Learning Objective	There are two modules in this course. The objective of the first module is to introduce the basic principles and procedure for the design and assessment of low-voltage and high-tension distribution networks. The objective of the second module is to provide a platform to apply the knowledge acquired on power system protection to solve some realistic protection problems in power distribution systems, taking into consideration of the relevant industrial standards.
Course Contents	In this design course, the students will apply the concepts of various power system analysis techniques and system performance criteria in designing a medium/low voltage distribution system and protection schemes for some typical industrial distribution networks. Students are required to carry out the detailed design with hands-on exercise and extensive use of computer simulation software. Students are also required to verify the results of the final design to meet specifications.
Prerequisite	EE3015 Power Systems and Conversion & EE3010 Electrical Devices & Machines
Contact Hours	Lectures (13); Practical Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Textbook(s)	• Kasikci Ismail, Analysis and Design of Low-voltage Power Systems: An Engineer's Field Guide, 1st Edition, Wiley-VCH, 2004. (TK1001.K19) • Blackburn J Lewis and Domin thomas J, Protective Relaying: Principles and Applications, 3rd Edition, CRC Press, 2007. (TK2861.B628 2007)

Reference(s)	• Code of Practice for Electrical Installations, (Singapore Standards, CP5 1998), Singapore Productivity and Standards Board, 1998. (QC100.S617 CP5 1998) • Anderson Paul M, Power System Protection, 1st Edition, McGraw-Hill, 1999. (TK1010.A548)

Course Code & Title	EE4504 – DESIGN OF CLEAN ENERGY SYSTEMS
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Ali I Maswood
Learning Objective	The main objective of this design course is to acquaint the students with engineering design and analysis techniques for clean energy systems. The course consists of two modules namely, (i) Design of Wind Energy Systems and (ii) Design of Solar Photovoltaic Systems. The basic design methodologies are applicable to other forms of clean or renewable energy systems, such as tidal barrage, tidal stream, solar thermal, geothermal, micro-hydro turbines and fuel cells. The detailed learning objectives cover the scientific and technological nature of the clean energy systems, geographical site selection, multi-stage energy conversion to electricity, electric power processing using power electronics, power grid interfacing and integration, and energy-efficient utilization.
Course Contents	Clean and renewable energy sources. Wind energy turbines and systems. Solar photovoltaic devices and systems. System-level designs. Analytical design and analysis. Modeling and simulation. Hands-on sessions using commercial software. Comprehensive case studies on wind and solar energy systems.
Prerequisite	EE3015 Power Systems and Conversion & EE3010 Electrical Devices & Machines
Contact Hours	Lectures (13); Practical Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Textbook(s)	• Simões Marcelo Godoy and Farret Felix A, Renewable Energy Systems – Design and Analysis with Induction Generators, 2nd Edition, CRC Press, 2007. (TJ808.S593 2007) • Green M A, Third Generation Photovoltaics Advanced Solar Energy Conversion, Springer, 2006.
Reference(s)	• Thomas Ackemann, Wind Power in Power Systems, 2nd Edition, John Wiley, 2013. (TK1541.W763 2012)

Course Code & Title	EE4530 – POWER SYSTEM ANALYSIS AND CONTROL
Study Year	4
Availability	Semester 1
Coordinator(s)	Dr Foo Yi Shyh, Eddy
Learning Objective	This course is designed to provide students with: 1) the fundamental concepts of analysis and control of power systems, 2) the understanding of the problems commonly encountered in power system engineering practice, and 3) the modelling, analysis and control techniques applied to solve some practical problems in power systems.
Course Contents	Power Flows. Active Power And Frequency Control. Reactive Power And Voltage Control. Power System Stability.
Prerequisite	EE3015 Power Systems and Conversion & EE3010 Electrical Devices & Machines
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments Written Examination (60%)
Textbook(s)	• Saadat Hadi, Power System Analysis, 3rd Edition, McGraw-Hill, 2010. (TK1001.S111 2010)
Reference(s)	• Weedy Birron Mathew and Cory Brian John, Electric Power Systems, 5th Edition, John Wiley, 2012. (TK1001.W394 2012) • Grainger John J and Stevenson William D, Power System Analysis, McGraw-Hill, 1994. (TK3001.G743)

Course Code & Title	EE4532 – POWER ELECTRONICS AND DRIVES
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Ali I Maswood
Learning Objective	The objective of this course is to familiarize the students with the utilization aspects of power engineering, more specifically the techniques of solid-state power conversions and their applications. To meet industry requirement for power electronic engineers, adequate practical knowledge on power semiconductors, converter topologies, control techniques and typical applications in motor drives and other applications are emphasized.
Course Contents	Introduction to Power Electronic Systems and Devices. Uncontrolled and Controlled Rectifiers. Hard Switching Power Converters. Principles and Control of Motor drives.

Prerequisite	EE3015 Power Systems and Conversion & EE3010 Electrical Devices & Machines
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments Written Examination (60%)
Textbook(s)	• Mohan Ned, Undeland Tore M and Robbins William P, Power Electronics: Converters, Applications and Design, 3rd Edition, John Wiley, 2003. (TK7881.15.M697 2003) • Rashid M H, Power Electronics: Circuits, Devices & Applications, 3rd Edition, Pearson/Prentice Hall, 2004. (TK7881.15.r224 2004)
Reference(s)	• Krein Philip T, Elements of Power Electronics, 1st Edition, Oxford University Press, 1998. (TK7881.15.K92) • Erickson Robert Warren and Maksimovic Dragan, Fundamentals of Power Electronics, 2nd Edition, Kluwer Academic/Springer, 2001. (TK7881.15.E68 2001)

Course Code & Title	EE4534 – MODERN DISTRIBUTION SYSTEMS WITH RENEWABLE RESOURCES
Study Year	4
Availability	Semester 2
Coordinator(s)	Dr Foo Yi Shyh, Eddy
Learning Objective	This course deals with the operation of modern electric power distribution systems, which are increasingly being connected with renewable energy sources. It discusses many overriding factors, particularly system efficiency and cost-effectiveness. In addition, power quality issues are addressed with specific focus on the impacts on modern electronic appliances and renewable generations. Greater emphasis is also given to the two widely tapped clean energy sources of solar and wind. The course aims to equip students with the fundamentals of renewable energy sources through comprehensive coverage of energy conversion processes to their applications. The topics taught complement the understanding of power distribution systems with integration of renewable energy sources and their impacts on each other.
Course Contents	Operation of distribution systems. Power quality. Solar power systems. Wind power systems.
Prerequisite	EE3015 Power Systems and Conversion & EE3010 Electrical Devices & Machines
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments Written Examination (60%)
Textbook(s)	• Pabla A S, Electric Power Distribution, 6th Edition, McGraw-Hill, 2011. (TK3001.P112e 2011) • Masters Gilbert M, Renewable and Efficient Electric Power Systems, 2nd Edition, John Wiley, 2013. (TK1005.M423 2013)
Reference(s)	• Dugan Roger C, McGranaghan M F, Santoso S and Beaty H Wayne, Electrical Power Systems Quality, 3rd Edition, McGraw-Hill, 2012. (TK1010.D866 2012) • Boyle Godfrey, Renewable Energy: Power for A Sustainable Future, 3rd Edition, Oxford University Press, 2012. (TJ808.R411re 2012)

Course Code & Title	EE4613 – CMOS PROCESS AND DEVICE SIMULATION
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Zhou Xing
Learning Objective	To reinforce and apply theories learned in semiconductor processing and device physics through practical design examples using industry-standard process and device simulation tools. To better understand the modern technology development and transistor design and optimization through process variation.
Course Contents	Virtual Wafer Fabrication. Virtual Device Simulation. Virtual Process Integration.
Prerequisite	EE3013 Semiconductor Devices and Processing
Contact Hours	Lectures (13); Practical Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Reference(s)	• Arora Narain, MOSFET Modeling for VLSI Simulation: Theory and Practice, World Scientific, 2007. (TK7871.95.A769M) • Tsividis Yannis and McAndrew Colin, Operation and Modeling of the MOS Transistor, 3rd Edition, Oxford University Press, 2011. (TK7871.99.M44T882 2011)

- Kramer Kevin M and Hitchon W Nicholas G, Semiconductor Devices: A Simulation Approach, Prentice-Hall, 1997. (TK7871.85.K89)

Course Code & Title	EE4614 – DEVICE PARAMETER EXTRACTION AND LAYOUT IMPLEMENTATION
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Wong Kin Shun, Terence
Learning Objective	1) To familiarize students on virtual device characterization using device simulator for obtaining MOSFET current-voltage and capacitance-voltage measurement. 2) To familiarize students on transistor parameter extraction for circuit simulation. 3) To perform circuit simulation using the transistor model and explore the impact of mask layout design on circuit performance.
Course Contents	Virtual Device Characterization. Transistor Parameter Extraction. Circuit Simulation and Mask Layout Design.
Prerequisite	EE3013 Semiconductor Devices and Processing
Contact Hours	Lectures (13); Practical Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Reference(s)	• Synopsis TCAD Manual – MEDICI. • Schroder Dieter K, Semiconductor Material and Device Characterization, 3rd Edition, IEEE Press, 2006. (QC611.S381 2006) • Liou Juin J, Ortiz-Conde Adelmo and Garcia-Sanchez F, Analysis and Design of MOSFETs – Modeling, Simulation, and Parameter Extraction, Kluwer Academic Publishers, 1999. (TK7871.95 L763) • Rabaey Jan M, Chandrakasan Anantha, and Nikolic Borivoje, Digital Integrated Circuits: A Design Perspective, 2nd Edition, Pearson Education, 2003. (TK7874.65.R112 2003

Course Code & Title	EE4645 – MICROFABRICATION ENGINEERING
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Tang Xiaohong
Learning Objective	To provide students with an in-depth knowledge on wafer fabrication and semiconductor characterization.
Course Contents	Crystal Growth and Wafer Preparation. Vacuum Science and Plasma. Rapid Thermal Processing. Advanced Deposition Techniques. Process Integration. Semiconductor Characterization Techniques. IC Manufacturing.
Prerequisite	EE3013 Semiconductor Devices and Processing
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Design Written Examination (60%)
Textbook(s)	• Stephen A. Campbell, Fabrication Engineering at the Micro- and Nanoscale, 4th Edition, Oxford University Press, 2013. (TK7871.85.C191f 2013)
Reference(s)	o Mahajan Subhash and SreeHarsha K S, Principles of Growth and Processing of Semiconductors, WCB/McGraw-Hill, 1999. (TK7871.85.M214) o Van Zant Peter, Microchip Fabrication: A Practical Guide to Semiconductor Processing, 6th Edition, McGraw-Hill, 2013. (TK7871.85.V217 2013) • Ghandhi Sorab Khushro, VLSI Fabrication Principles: Silicon and Gallium Arsenide, 2nd Edition, John Wiley, 1994. (TK7874.G411 1994)

Course Code & Title	EE4646 – VLSI TECHNOLOGY
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Chen Tupei
Learning Objective	1) To study advanced MOS and bipolar transistor structures, VLSI process technologies and process integration; 2) To study some important aspects of VLSI technology including MOS scaling, small dimension effects, CMOS latchup and isolation.
Course Contents	Advanced MOS structures and process technology. Advanced bipolar transistors and process technology. MOS scaling rules and small geometry effects. CMOS latchup and isolation.
Prerequisite	EE3013 Semiconductor Devices and Processing

Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Report Written Examination (60%)
Textbook(s)	• Sze S M and Lee M K, Semiconductor Devices, Physics and Technology, 3rd Edition, John Wiley & Sons 2013. (TK7871.85.S997 2013) • Chang C Y and Sze S M, ULSI Devices, John/Wiley 2000. (TK7874.76.U46D)
Reference(s)	• Kuo James B and Lin Shih-Chia, Low-Voltage SOI CMOS VLSI Devices and Circuits, Wiley, 2001. (E-Book) (TK7874.66.K96V) • Houssa Michel, High-k Gate Dielectrics, Institute of Physics, 2004. (TK7871.99.M44H638K) • Neamen Donald A, Semiconductor Physics and Devices: Basic Principles, 4th Edition, McGraw-Hill, 2012. (QC611.N348 2012) • Wolf Stanley and Tauber Richard N, Silicon Processing for the VLSI Era, Vol.1, 2nd Edition, Lattice Press 2000. (TK7874.W855 2000 V1) • Chang C Y and Sze S M, ULSI Technology, McGraw-Hill 1996. (TK7874.76.U46)

Course Code & Title	EE4647 – MICROELECTRONIC DEVICES
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Ang Diing Shenp
Learning Objective	To understand and familiarize with the characteristics and principle of operation of the semiconductor devices which include diode, Bipolar junction transistor (BJT), metal-oxide semiconductor field effect transistor (MOSFET) and heterojunction devices.
Course Contents	Bipolar devices. MOS physics. MOSFET device characteristics and modelling. Introduction to Heterojunction devices.
Prerequisite	EE2003 Semiconductor Fundamentals
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments; Class Participation Written Examination (60%)
Textbook(s)	• Neamen Donald A, Semiconductor Physics and Devices: Basic Principles, 4th Edition, McGraw-Hill, 2012. (QC611.N348 2012) • Sze S M, Semiconductor Devices, Physics and Technology, 3rd Edition, John Wiley, 2012. (TK7871.85.S997 2012)
Reference(s)	• Dimitrijev Sima, Understanding Semiconductor Devices, Oxford University Press, 2000. (TK7871.85.D582)

Course Code & Title	EE4694 – IC RELIABILITY AND FAILURE ANALYSIS
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Tse Man Siu
Learning Objective	1) To expose students to the various failure mechanisms and the physics of failure in integrated circuits and their analysis methodologies. 2) To teach students to understand the importance of reliability in integrated circuit technology and the method of evaluating the reliability of the technology.
Course Contents	Basic reliability engineering concept. Statistical aspect of reliability and data handling. Microelectronic device failure mechanisms. Failure analysis techniques and instrumentation.
Prerequisite	EE3013 Semiconductor Devices and Processing
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Test Written Examination (60%)
Textbook(s)	• Ebeling Charles E, An Introduction to Reliability and Maintainability Engineering, 2nd Edition, Waveland Press, 2010. (TA169.E15 2010)
Reference(s)	• Ohring Milton, Kasprzak, Lucian Reliability and Failure of Electronic Materials and Devices, Academic Press, 1998. (TK7870.23.H38 2015) • Charles R. Brooks, Ashok Choudury and Charlie R. Brooks, "Failure analysis of Engineering materials", McGraw-Hill, 2002. (TA409.B873) • Alvin W. Strong, Ernest Y. Wu, Rolf-Peter Vollertsen, Jordie Sune, Giuseppe La Rosa, Stewart E. Rauch III and Timothy D. Sullivan, "Reliability Wearout Mechanisms in Advanced CMOS Technologies", IEEE Press, 2009. (TK7871.99.M44R382)

Course Code & Title	EE4717 – WEB APPLICATION DESIGN
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Chong Yong Kim
Learning Objective	The objective of this subject is to provide students with a clear understanding of the architecture of web applications, as well as skills and knowledge to design and construct such applications.
Course Contents	This design course will equip students with principles, knowledge and skills for the design and construction of web-enabled Internet applications. It deals with challenges raised in wide-area distributed computing, including persistence, concurrency and transaction, as well as technologies for creating, managing, and tracking web-interaction state in the environments where the connections are inherently unreliable and protocols are inherently stateless. Specifically, the content covers the architecture of web applications, data presentation, server side programming, data access, state management, data exchange and XML, web services, and personalization. Lab facilities and guidance are provided for the students to practice on the technologies and the skills, go through the steps of web applications, i.e. design, implementation and deployment, with an in house project.
Prerequisite	Nil
Contact Hours	Lectures (13); Practical Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Reference(s)	• Douglas K. Van Duyne; James A. Landay; Jason I. Hong, The Design of Sites, 2nd Edition, Prentice Hall PTR, 2006. (TK5105.888.V36) • Terry Felke-Morris, Basics of Web Design: HTML5 & CSS3, 2nd Edition, Addison-Wesley Longman, 2013. ISBN: 978-0-13-312891-8 • Welling Luke, Thomson Laura, PHP and MySQL Web Development, 4th Edition, Addison Wesley, 2009. (QA76.73.P224W452 2009) • Larry Ullman, Modern JavaScript: Develop and Design, Peachpit Press, 2012, ISBN: 978-0321812520.

Course Code & Title	EE4718 – ENTERPRISE NETWORK DESIGN
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Xiao Gaoxi
Learning Objective	The subject aims to provide students the knowledge for designing, setting up and managing an IP based enterprise network. Students will acquire necessary practical skills in planning and configuring an IP network, using simulation and monitoring tools to analyse the network performance.
Course Contents	This subject covers network technologies and protocols, network planning and design methodologies. Besides acquiring the theoretical background in enterprise networking, students will learn to set up, configure and interconnect an IP network in the lab sessions. Network monitoring and management tools will also be introduced to the students. The students will also acquire the knowledge to use simulation tool to design an enterprise network and evaluate design alternatives. Based on the knowledge and skills, the students are to finish a design of an enterprise network to support applications such as electronic mails, centralised database access, and client-server applications. Various issues such as IP addresses assignment, choice of internetworking equipment and network performance will be considered in the network design.
Prerequisite	EE3017 Computer Communications
Contact Hours	Lectures (13); Practical Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Reference(s)	• Leon-Garcia Alberto and Widjaja Indra, Communication Networks: Fundamental Concepts and Key Architectures, 2nd Edition, McGraw-Hill, 2004. (TK5101.L579 2004) • Kurose James F and Ross Keith W, Computer Networking: A Top-Down Approach, 6th Edition, Pearson, 2013. (TK5105.875.I57K96 2013) • CCIE Fundamentals: Network Design and Case Studies, 2nd Edition, Cisco Press, 2002. (TK5105.5.C386) • Priscilla Oppenheimer, Top-Down Network Design, 3rd Edition, Cisco Press, 2011. (TK5105.5.P62 2011)

Course Code & Title	EE4756 – COMPUTER ARCHITECTURE

Study Year	4
Availability	Semester 2
Coordinator(s)	Prof Lim Yong Ching
Learning Objective	The objective of this course is to provide students with the basic concepts and principles in computer architecture so that students have in-depth understanding of computer system organizations and computer system designs.
Course Contents	Fundamental of Computer Design. Instruction Set Architecture. Memory-system Architecture. Buses, Storage Devices and I/O System. RISC Design. Pipelining.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments Written Examination (60%)
Textbook(s)	• Hennessy John L and Patterson David A, Computer Architecture: A Quantitative Approach, 5th Edition, Morgan Kaufmann, 2012. (QA76.9.A73H515 2012)
Reference(s)	• Patterson David A and Hennessy John L, Computer Organization and Design: The Hardware/Software Interface, (ARM edition), 5th Edition, Morgan Kaufmann 2014. (QA76.9.C643P317 2014)

Course Code & Title	EE4758 – INFORMATION SECURITY
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Mohammed Yakoob Siyal
Learning Objective	This subject intends to provide students with essential concepts of information security, cryptography, secure protocols, detection and other security techniques.
Course Contents	Introduction. Secret / public-key cryptosystems. Secure protocols. Electronic election and digital money. Intrusion detection, social networks and cyber security.
Prerequisite	Nil
Contact Hours	Lectures (Online); Interactive Tutorial Sessions (24)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments Written Examination (60%)
Textbook(s)	• Stallings William, Cryptography and Network Security: Principles and Practice, 7th Edition, Pearson/Prentice-Hall, 2017.
Reference(s)	• Michael Goodrichand Roberto Tamassia, Introduction to Computer Security, Pearson Education, 2014. • William (Chuck) Easttom II, Computer Security Fundamentals, Pearson Education, 2016.

Course Code & Title	EE4761 – COMPUTER NETWORKING
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Ma Maode
Learning Objective	The subject is intended to provide students with: 1) A basic understanding of concepts and protocols used in computer networking, 2) An in-depth knowledge of routing algorithms, congestion and flow control mechanisms, and naming and addressing mechanisms used in the network and transport layers, 3) A strong theoretical and practical foundation to become a competent network professional.
Course Contents	Computer network architecture and services. Internetworking protocols and routing. Transport protocols. Application services and multimedia networking.
Prerequisite	EE3017 Computer Communications
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Class Participation Written Examination (60%)
Textbook(s)	• Kurose James F and Ross Keith W, Computer Networking: A Top-Down Approach, 6th Edition, Addison-Wesley, c2013. (TK5105.875.I57K96 2013)
Reference(s)	• Leon-Garcia Alberto and Widjaja Indra, Communication Networks: Fundamental Concepts and Key Architectures, 2nd Edition, McGraw-Hill, 2004. (TK5101.L579 2004) • Stallings William, Data and Computer Communications, 10th Edition, Pearson/Prentice-Hall, 2014. (TK5105.S782 2014)

- Comer Douglas E, Internetworking with TCP/IP, 6th edition, Pearson Prentice-Hall, 2014. (TK5105.585.C732 2014 V1)

Course Code & Title	EE4791 – DATABASE SYSTEMS
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Wang Lipo
Learning Objective	Database has become part of our daily life. Almost all business and engineering systems now rely on some kind of database. At the heart of every modern information system is a database that would affect the quality of the system decisions, output and performance. The proper understanding, design, and management of a database are crucial to the efficiency of application programs and the effectiveness of computer-based user functions. The objective of the subject is to provide a good fundamental understanding of the theories and practices of database systems for various application domains such as business, engineering, and manufacturing. It examines the full spectrum of database management: data modeling, logical and physical database design, query language, database administration, and offers an appreciation for more advanced database technologies such as web databases, and data warehousing.
Course Contents	Introduction to Database and Data Modelling. Logical Database Design and The Relational Model. The Structured Query Language (SQL). Physical Database Design. Database Administration. Client/Server Database. Data Warehousing.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Project Written Examination (60%)
Textbook(s)	• Hoffer Jeffrey A, Ramesh V and Topi Heikki, Modern Database Management, 11th Edition, Pearson/Prentice-Hall, 2013. (QA76.9.D3M143 2013)
Reference(s)	• Elmasri Ramez and Navathe Shamkant B., Database Systems: Models, Languages, Design and Application Programming, 6th Edition, Pearson, 2011. • Coronel Carlos, Morris Steven and Rob Peter, Database Systems: Design, Implementation, and Management, 11th Edition, Course Technology, 2014.

Course Code & Title	EE4838 – LASER ENGINEERING AND APPLICATIONS
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Tang Xiaohong
Learning Objective	The course aims to provide students an introductory level of knowledge on: 1) The principles of lasers, basic laser techniques and laser system design; 2) The applications of lasers in industry, optical communications, medicine and scientific research.
Course Contents	Laser fundamentals. Laser cavities. Laser oscillation. Laser techniques. Design of laser systems. Laser applications in sensing, metrology and data storage. Laser applications in industry. Laser applications in medicine and biology.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Class Participation Written Examination (60%)
Textbook(s)	• Svelto Orazio, Principles of Lasers, 5th Edition, Springer, 2010.
Reference(s)	• Graham-Smith Francis Sir, King Terry A and Wilkins Dan, Optics and Photonics: An Introduction, 2nd Edition, John Wiley, c2007. (QC446.2.G742 2007) • Vij D R and Mahesh K, Medical Applications of Lasers, Kluwer Academic, 2002. (R857.L37M489)

Course Code & Title	EE4840 - BIOPHOTONICS
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Poenar, Daniel Puiu
Learning Objective	This course will introduce students to the principles and applications of biophotonics, which has played an enabling role in the rapidly growing fields of life sciences.

Course Contents	Fundamentals of Biophotonics, Bioimaging Principles and Techniques, Optical Biosensors, Laser-Photomedicine, Applications of Biophotonics.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quiz; Assignment; Class Participation Written Examination (60%)
Textbook(s)	• Prasad Paras N, Introduction to Biophotonics, Wiley-Interscience, 2003. (QH515.P911)
Reference(s)	• Tözeren Aydin and Byers Stephen W, New Biology for Engineers and Computer Scientists, Pearson/Prentice Hall, 2004. (QH506.T314) • Niemz Markolf H, Laser-Tissue Interactions [electronic resource]: Fundamental and Applications, 3rd Edition, Springer, 2007. • Vo-Dinh Tuan, Biomedical Photonics Handbook, CRC Press, 2003. (R857.O6.B615B)

Course Code & Title	EE4901 – BIOMEDICAL CONTROL SYSTEM DESIGN
Study Year	4
Availability	Semester 1
Coordinator(s)	Prof Wen Changyun
Learning Objective	It is known that biomedical systems contain many feedback mechanisms and structures. Thus, the design and analysis of biological control systems have become a very important part biomedical engineering. The main objective of this design subject is to introduce the basic techniques employed in biomedical system analysis, modeling, control and simulation. Principles of control system design based on time domain and frequency domain will be covered. Students will explore the basic design of the musculoskeletal and cardiovascular control systems.
Course Contents	This design course is an introduction to biomedical system modeling and control, focusing on the synthesis of control techniques for biomedical systems. The musculoskeletal and cardiovascular systems will be used as illustrative examples.
Prerequisite	Nil
Contact Hours	Lectures (13); Practical Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Reference(s)	• Khoo Michael C K, Physiological Control Systems: Analysis, Simulation and Estimation, IEEE Press, 2000. (QP33.6.M36K45) • Kuo Benjamin C and Golnaraghi Farid, Automatic Control Systems, 9th Edition, John Wiley, 2008. • Little John N, Control System Toolbox for Use with MATLAB: User's Guide, The Math Works, Inc. 1998. (QA297.C764)

Course Code & Title	EE4902 – DESIGN OF MEDICAL INFORMATION PROCESSING SYSTEMS
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Mao Kezhi
Learning Objective	Image and signal processing techniques have been widely used in the medical profession in the diagnosis and treatment of a variety of illnesses. Hence, the processing and analysis of bio-medical signals and images are considered as essential technologies in the bio-medical engineering profession. The objective of this design subject is to provide students with an opportunity to acquire in-depth theoretical and practical knowledge on selected aspects of biomedical signals and images, and the synthesis of processing techniques.
Course Contents	This module is on the design of software/hardware systems for biomedical signal and image processing and analysis.
Prerequisite	Nil
Contact Hours	Lectures (13); Practical Sessions (26)
Academic Units	2
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Reference(s)	• Bruce Eugene N, Biomedical Signal Processing and Signal Modeling, John Wiley, 2001. (R857.S47B886) • Proakis John G and Manolakis Dimitris G, Digital Signal Processing: Principles, Algorithms and Applications, 4th Edition, Pearson Prentice-Hall, c2007. (TK5102.9.P932)

- Blake Andrew and Isard Michael, Active Contours: The Application of Techniques from Graphics, Vision, Control Theory and Statistics to Visual Tracking of Shapes in Motion, Springer, 1998. (TA1634.B636)

Course Code & Title	EE4903 – PHYSIOLOGICAL SYSTEMS ANALYSIS
Study Year	4
Availability	Semester 1
Coordinator(s)	Assoc Prof Mao Kezhi
Learning Objective	The objective of this course is to introduce engineering students to the analysis and modeling of physiological systems using concepts from linear systems and control theory. It allows students to integrate and apply engineering analytical techniques to biological and physiological systems.
Course Contents	System Modelling, Control and Analysis. The Respiratory System. The Cardiovascular System. The Neuromuscular System. The Renal System.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Class Participation Written Examination (60%)
Reference(s)	• Widmaier Eric P, Raff Hershel, Strang Kevin T and Vander Arthur J, Vander's Human Physiology: The Mechanisms of Body Function, 13th Edition, McGraw-Hill, 2014. (QP34.5.V228 2014) • Khoo Michael C K, Physiological Control Systems: Analysis, Simulation, and Estimation, IEEE Press, 2000. (QP33.6.M36K45) • Marieb Elaine Nicpon, Essentials of Human Anatomy and Physiology, 10th Edition, Benjamin Cummings, 2011. (QP34.5.M334 2011) • Silverthorn Dee Unglaub, Human Physiology: An Integrated Approach, 6th Edition, Pearson/Benjamin Cummings, 2013. (QP34.5.S587 2013)

Course Code & Title	EE4904 – BIOMEDICAL INSTRUMENTATION
Study Year	4
Availability	Semester 2
Coordinator(s)	Assoc Prof Dauwels, Justin
Learning Objective	The objective of this subject is to describe the principles, applications and the design of the medical instruments most commonly used in hospitals. Fundamental principles of operation and quantitative analysis and design of medical instrumentation systems for diagnostic and therapeutic medical applications are taught.
Course Contents	Introduction to Biomedical Instrumentation. Biopotential Electrodes. Electrocardiography. Blood Pressure, Heart Sounds and Blood Flow. Respiratory System Measurements. Instrumentation for Medical Imaging. Therapeutic Devices. Electrical Safety in Hospitals.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments Written Examination (60%)
Textbook(s)	• Webster John G and Clark John W, Medical Instrumentation: Application and Design, 4th Edition, John Wiley, 2010. (R856.M489 2010) • Carr, Joseph J and Brown John M, Introduction to Biomedical Equipment Technology, 4th Edition, Prentice Hall 2001. (R856.C311 2001)
Reference(s)	• Brown B H, Medical Physics and Biomedical Engineering, Institute Of Physics, 1999. (R895.M489) • Bushberg Jerrold T, Seibert J A, Leidholdt E M and Boone J M, The Essential Physics of Medical Imaging, 2nd Edition, Lippincolt Williams & Wilkins, 2002. (RC78.7.D53E78) • Ganong William F, Ganong's Review of Medical Physiology, 24th Edition, McGraw-Hill Medical, 2012.

Course Code & Title	EE8061 - INNOVATION AND TECHNOLOGY MANAGEMENT
Study Year	GER Elective (Optional)
Availability	Semester 1
Coordinator(s)	Assoc Prof Mohammed Yakoob Siyal
Learning Objective	The course aims to provide a broad understanding of the dynamics of technological development through innovation and the related management issues and practices.
Course Contents	Overview. Patterns of Technology Development. External Environment. Internal Environment and Processes. Financial Fundamentals, Funding and Risk Management.
Prerequisite	Nil
Contact Hours	Lectures (39)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes Written Examination (60%)
Textbook(s)	• Burgelman et al. Strategic Management of Technology and Innovation 4th Edition, McGraw-Hill, 2004.
Reference(s)	• Dorf Richard C and Byers Thomas H, Technology Ventures: from Idea to Enterprise, 5th Edition, McGraw-Hill, 2017. • Joe Tidd, John Bessant Managing Innovation: Integrating Technological, Market and Organizational Change, 5th Edition, Wiley 2013.

Course Code & Title	EE8064 - INTELLECTUAL PROPERTY FOR ELECTRONIC ENGINEERS
Study Year	GER Elective (Optional)
Availability	Semester 2
Coordinator(s)	Asst Prof Kong Zhi Hui, Natalie
Learning Objective	The course aims to equip students with essential knowledge about Intellectual Property (IP) and its significance in the electronics/semiconductor/IC design industry. There is a need to move towards innovation and enterprise, and research and development to rejuvenate future economic growth. The knowledge-intensive electronics industry is one such area that provides a realm for innovation, and therefore, its chemistry with the IP Law is important. The search for new and more innovative electronic gadgets can continue to be pursued only by acquiring legal protection via IP rights. As a result, students should equip themselves with substantial understanding of the numerous forms of IP and the governing legal principles to efficiently protect and exploit their own inventions, on top of thriving on the ownership of IP.
Course Contents	Significance of the Electronics Industry. Intellectual Property Rights (IPRs). Ownership and Commercial Dealing. Case Studies.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments Written Examination (60%)
Textbook(s)	• Yeo Kiat Seng, Ng Kim Tean, Kong Zhi Hui and Dang Bee Yoke, Intellectual Property for Integrated Circuits, J. Ross, 2010. (K1401.I61PN)
Reference(s)	• Rockman Howard B, Intellectual Property Law for Engineers and Scientists, John Wiley, 2004. (KF2979.R683) • Ng-Loy, Wee Loon, Law of Intellectual Property of Singapore, 2nd Edition, Sweet & Maxwell, 2014

Course Code & Title	EE8067 - CERAMICS IN HISTORY, ARTS, GEMSTONES, ENVIRONMENT & MODERN LIFE
Study Year	GER Elective (Optional)
Availability	Semester 1
Coordinator(s)	Prof Zhu Weiguang
Learning Objective	Ceramics have a wide range of forms such as rocks, soils, sands, gemstones, architecture blocks, and as various functional materials from insulator to semiconductor to superconductor, piezoelectric, ferroelectrics, ferromagnetic, optical ceramics, etc. This course will introduce students to the basic concepts and applications in electrical, electronic, optical, energy, civil, environment and pollution control areas and allow them to learn the role of ceramics in history, arts, social and cultural development, and appreciate the fact that we live in, touch on, and use ceramics in our daily modern life.
Course Contents	Definition of ceramics and overview. Ceramics in History and Art. Fundamental Concepts. Jewelleries and Gemstones. Ceramics in Civil and Environment. Ceramics in Electrical and Electronic devices, Science, Technology and Applications of ceramics in modern life.
Prerequisite	O-level Physics or equivalent

Contact Hours	Lectures (39)
Academic Units	3
Assessment Modes	Continuous Assessment (50%) – Quizzes Written Examination (50%)
Textbook(s)	• Richerson, David W, The Magic of Ceramics [Electronic Resource], 2nd Edition, Wiley, 2012. • Hench L L and West J K, Principles of Electronic Ceramics, Wiley, 1990. (TK7871.15.C4H494)
Reference(s)	• Kingery W D, The Changing Roles of Ceramics in Society: 26,000 B.P. to the Present, American Ceramic Society, 1990. (TP791.C456) • Callister William D and Rethwisch David G, Materials Science and Engineering: An Introduction, 9th Edition, John Wiley, 2014. (TA403.C162 2014) • Nelson, Glenn C and Richard Burkett, Ceramics: A Potter's Handbook, Wadsworth/Thomson Learning, 2002. (TP807.N426) • Price Monica, Decorative Stone: The Complete Sourcebook, Thames & Hudson, 2007. (TN950.P946)

Course Code & Title	EE8084 - CYBER SECURITY
Study Year	GER Elective (Optional)
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Wang Lipo (Semester 1) ; Dr Chan Chee Keong (Semester 2)
Learning Objective	The objective of this course is to provide students with basic appreciation and understanding of the underlying security issues and implications of the use of various networked systems and electronic devices in the modern cyber-society from both user and management perspectives. Topics to be covered include overview of information systems and devices in a global network environment, threats to information systems and devices, security models, and concepts for secrecy, integrity and availability. Other topics of security concerns will also be explored: evaluations of secure information systems, security requirements analysis, security management policies, security trends and emerging technologies.
Course Contents	Introduction to Cyber Crimes and Security Issues in a Cyber-environment. Digital Liability Management. Security Planning and Management. Security Solutions and Technologies. Web Security and Electronic Payment Models. Security Applications and Cases.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Textbook(s)	• Tsai Flora S and Chan Chee Keong, Cyber Security, Pearson Custom, 2006. (TK5105.59.C994) • Principles of Information Security, 5th Edition, Michael E. Whitman and Herbert J. Mattord, Cengage Learning 2014.
Reference(s)	• Volonino Linda, Robinson Stephen R and Volonino Charles P, Principles and Practice of Information Security: Protecting Computers from Hackers and Lawyers, 1st Edition, Pearson/Prentice-Hall, 2004. (TK5105.59.V929) • Stallings William, Network Security Essentials: Applications and Standards, 5th Int' l Edition, Pearson Prentice-Hall, 2013. (TK5105.59.S782N 2013) • Maiwald Eric, Fundamentals of Network Security, McGraw-Hill, 2004. (TK5105.59.M232F) • Ng Jessica, Tsai Flora S and Foo Say Wei, E-Business Management, Pearson Education, 2006. (HF5548.32.E11B)

Course Code & Title	EE8085 - ELECTRIFICATION FOR THE BUILT ENVIRONMENT
Study Year	GER Elective (Optional)
Availability	Semester 1
Coordinator(s)	Dr FOO YI SHYH, EDDY
Learning Objective	The objective of this course is to impart to students knowledge pertaining to the generation and distribution of electricity, and how electricity usage impacts on a modern society. Essential aspects of power system technology, electricity utilization and recent developments on electricity industry restructuring would be discussed. Energy conservation and safety issues will also be covered.
Course Contents	Conventional sources of electricity generation, transmission and distribution systems. Clean/green power and renewable sources. Liberalization of electricity industry and energy procurement. Electricity utilization and quality. Energy conservation. Safety.
Prerequisite	Nil
Contact Hours	Lectures (39)
Academic Units	3

Assessment Modes	Continuous Assessment (40%) – Quiz; Assignments; Class Assignments Written Examination (60%)
Textbook(s)	• Darryl R. Biggar and Mohammad Reza Hesamzadeh, The Economics of Electricity Markets (Wiley - IEEE) 1st Edition, 2014.
Reference(s)	• Sally Hunt, Making Competition Work in Electricity, John Wiley and Sons, New York 2002.

Course Code & Title	EE8086 - ASTRONOMY- STARS, GALAXIES AND COSMOLOGY
Study Year	GER Elective (Optional)
Availability	Semester 1 ; Semester 2
Coordinator(s)	Assoc Prof Yong Ken Tye ; Assoc Prof Poenar, Daniel Puiu
Learning Objective	The basic goal of this course is to give students a fundamental understanding of astronomy. Through the course, the students will learn about the birth of the universe, the origin of galaxies, the evolution of stars and the formation of planets. Our solar system will be one of the main topics to be studied. Some unanswered mysteries of the universe and mankind will be discussed and hopefully lead the students to further their own exploration. During this course, the diverse facts that form the context of a science will be delivered. During the course, students will also have opportunities to participate in various practical sessions and trips may be organized where appropriate.
Course Contents	The origin of modern astronomy – an introduction, Learn to read the stars, Overview of the solar system, The beginning and life of stars, The mysteries ahead, The future of space exploration.
Prerequisite	Nil
Contact Hours	Lectures & Hands-on Sessions (39)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes Written Examination (60%)
Textbook(s)	• Bennett Jeffrey O, The cosmic perspective: stars, galaxies & cosmology, 8th edition, Pearson Addison-Wesley, 2016. (QB43.3.C834 2010)
Reference(s)	• Seeds Michael A, Horizons: Exploring the Universe, 13th Edition, Thomson Brooks/Cole, 2014. (QB45.2.S451 2014) • Bennett Jeffrey O, On the Cosmic Horizon: Ten Great Mysteries for Third Millennium Astronomy, Addison-Wesley, 2001. (QB43.2.B471)

Course Code & Title	EE8087 - LIVING WITH MATHEMATICS
Study Year	GER Elective (Optional)
Availability	Semester 2
Coordinator(s)	Asst Prof Mo Yilin
Learning Objective	Mathematics plays a fundamental role in everyday life. The purpose of this course is to explore the various topics of mathematics, e.g. algebraic equations, trigonometry, conic sections, functions, differentiation and integration, which have direct applications in real world problems. Students will learn (i) how to translate real life problems into appropriate mathematical context and (ii) skills and techniques for solving these problems.
Course Contents	Solving algebraic equations and applications. Trigonometry with applications. Conic sections: straight line, circle, hyperbola, parabola, ellipse. Planets of the universe. Functions in daily life. Applications of differentiation and integration. Personal finance.
Prerequisite	Nil
Contact Hours	Lectures (26); Tutorial Sessions (12)
Academic Units	3
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Reference(s)	• Jordan D W and Smith Peter, Mathematical Techniques: An Introduction for the Engineering, Physical, and Mathematical Sciences, 4th Edition, Oxford University Press, 2008. (QA300.J82 2008) • Strauss Monty J, Smith Karl J and Bradley Gerald L, Calculus, 3rd Edition, Prentice Hall, 2002. (QA303.B811) • Hughes-Hallett Deborah, Calculus, 4th Edition, John Wiley, 2005. (QA303.C144C 2005) • Stewart James, Calculus, 7th Edition, Thomson Brooks/Cole, 2012. (QA303.2.S849 2012)

Course Code & Title	EE8092 - DIGITAL LIFESTYLE
Study Year	GER Elective (Optional)
Availability	Semester 2
Coordinator(s)	Assoc Prof Chong Yong Kim

Learning Objective	iPod and MP3 players, 3G mobile phones, Multi-megapixel digital cameras, Spy cameras, 3CCD video camcorders, Intel Pentium Core-Duo Processors, Xbox/Playstation, LCD/Plasma/HD TVs, and Dolby Digital Surround Sound play a big part in our lives today, but do you really know how these digital gadgets and technologies work? Do you know how to choose among the various brands and features that best suit your budget and requirements? Enroll into this course, and you won't be baffled by salespersons, advertisements and terminologies. The digital gadgets and lifestyle covered in this course include: Home Entertainment Systems, Game Consoles, Digital Audio Players and Systems, Digital Cameras and Video Camcorders, Personal Computers, Mobile Phones and PDA.
Course Contents	Home Entertainment Systems and Game Consoles. Digital Audio Systems. Digital Cameras and Video Camcorders. Personal Computers. Mobile Phones and PDA.
Prerequisite	Nil
Contact Hours	Lectures (39)
Academic Units	3
Assessment Modes	Continuous Assessment (50%) Written Examination (50%)
Textbook(s)	• Shelly Gary B and Vermaat Misty E., Discovering Computers – Complete: Your Interactive Guide to the Digital World, International Edition, 1st Edition, Cengage Learning, 2013. (ISBN-13: 9781285082356) • Gonzalez Barb, The Home Electronics Survival Guide. Volume 1 : The Simple guide to Understanding, Hooking up, and Buying TV's HDTVs, DVDs, DVRs, Home Theatre, Remote Controls and More, Home Electronics Survival, 2005. (TK9965.G643)
Reference(s)	• Pohlmann Ken C, Principles of Digital Audio, 6th Edition, McGraw-Hill, 2011. (TK7881.4.P748 2011) • Underdahl Keith, Digital Video for Dummies, 4th Edition, John Wiley, 2006. (TR896.U55) • Mark Galer, Digital Photography: Essential Skills, Fourth Edition, Elsevier/Focal, 2008. • Mallick Martyn, Mobile and Wireless Design Essentials, Wiley; 2003. (TK5103.2.M254)

Course Code & Title	EE8093 - ENERGY DEVICES FOR SUSTAINABLE URBAN ENVIRONMENT
Study Year	GER Elective (Optional)
Availability	Semester 2
Coordinator(s)	Asst Prof Cuong Dang
Learning Objective	This course will introduce students to the basic operating principles and applications of photovoltaic devices used for solar energy conversion, thermoelectric devices for energy harvesting and electrochemical devices for renewable energy storage.
Course Contents	Sustainability Concepts. Crystalline Solar Cells. Thin Film Solar Cells. Thermoelectric Devices. Supercapacitors. Batteries.
Prerequisite	Nil
Contact Hours	Lectures (39)
Academic Units	3
Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignment; Class Participation Written Examination (60%)
Textbook(s)	• Wenham S R, Green M A, Watt M E and Corkish R, Applied Photovoltaics, 3rd Edition, Earthscan, 2012. (TK1087.A652 2012) • Hamann Carl H, Hamnett Andrew and Vielstich Wolf, Electrochemistry, 2nd Edition, Wiley-VCH, 2007. (QD553.H198 2007)
Reference(s)	• Luque Antonio and Hegedus Steven, Handbook of Photovoltaic Science and Engineering, 2nd Edition, Wiley, 2011. (TK8322.H236) • Brian E. Conway, Electrochemical Supercapacitors, 1st edition, Kluwer Academic / Plenum Press, 2014.

Course Code & Title	EE8094 - EFFECTS OF ELECTROMAGNETIC RADIATION ON HUMANS
Study Year	GER Elective (Optional)
Availability	Semester 1 ; Semester 2
Coordinator(s)	Prof Lu Yilong
Learning Objective	The main objective is to educate students the basic knowledge to understand the effects of increasing use of electricity, cellular phones, security check, and medical applications of electromagnetic radiation.
Course Contents	Fundamental of Electromagnetic Radiation. Impacts of Radio Transmission. Impacts of Wireless Technologies. Impacts of Lasers and Light Sources. Impacts of X-Ray and Tera-Hertz Technologies. Impacts of UV and Gamma Rays.
Prerequisite	Nil
Contact Hours	Lectures (39)
Academic Units	3

Assessment Modes	Continuous Assessment (40%) – Quizzes; Assignments Written Examination (60%)
Reference(s)	• Peter Stavroulakis (ed.), Biological Effects of Electromagnetic Fields: Mechanisms, Modeling, Biological Effects, Therapeutic Effects, International Standards, Exposure Criteria, Springer, 2003. • Tom A. Wheeler, Electronic Communications for Technicians, 2nd Edition, Pearson Prentice Hall, 2006. (TK5101.W564 + 1 CD) • Jeff Hecht, Understanding Lasers, An Entry-Level Guide, 3rd Edition, Wiley, 2008. • Frank S Barnes and Ben Greenebaum, Biological and Medical Aspects of Electromagnetic Fields, 3rd Edition, CRC Press, 2006. (QP82.2.E43H236) • IEEE Standard for Safety Levels with Respect to Human Exposure to Radio-Frequency Electromagnetic Fields, 3 kHz to 300 GHz (IEEE C95.1-2005). The Institute of Electrical and Electronics Engineers, Inc., New York, Revision of IEEE Std C95.1-1991.

Course Code & Title	EE8095 - INNOVATION AND COMMERCIALIZATION
Study Year	GER Elective (Optional)
Availability	Semester 1
Coordinator(s)	Assoc Prof Khong W H, Andy
Course Contents	This course covers the fundamental process of innovation through its implications on organizations and innovation ecosystems. It emphasizes historical and modern examples of innovation in materials and devices, and discusses the final implications for innovation ecosystems. This course also presents a simple model for students to understand the innovation process as a highly iterative process, in which many factors in the areas of Technology, Market and Implementation are cycled repeatedly through until the right pieces come together.
Prerequisite	Nil
Contact Hours	Online
Academic Units	3
Assessment Modes	Continuous Assessment (100%) – Online Exercises; Assignments; Oral Presentation
Textbook(s)	• Eugene Fitzgerald, Andreas Wankerl, and Carl J. Schramm, Inside Real Innovation: How the Right Approach Can Move Ideas from R&D to Market - And Get the Economy Moving, World Scientific, 2011.
Reference(s)	• The online reading material will be available through the course website.