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ABOUT THE INSTITUTE

The Electrical and Electronics Engineering Institute of the College of Engineering, University of the Philippines Diliman (UP EEEI) celebrated its one hundred years of honor and excellence in the fields of electrical, electronics, and computer engineering last 2016. From the establishment approval of the BS Electrical Engineering curriculum, leading to the establishment of the then Department of Electrical Engineering on 10 January 1916, which later became the Department of Electrical and Electronics Engineering in 1994, and Electrical and Electronics Engineering Institute in 2008, the UP EEEI continues to uphold its ideals as the premier institution for research and higher learning.

The Institute offers three undergraduate programs-- Bachelor of Science in Electrical Engineering (BSEE), Bachelor of Science in Computer Engineering (BSCoE), and the Bachelor of Science in Electronics and Communications Engineering (BSECE) programs. In addition are four graduate programs namely Master of Science and Master of Engineering in Electrical Engineering; and the Doctor of Philosophy and Doctor of Engineering (Electrical and Electronics Engineering), which provide training and specialization to prepare students to solve complex technological problems and to contribute new knowledge to the field.

The Institute also houses 13 research laboratories, 14 instructional laboratories, and other learning facilities such as lecture rooms and meeting space which serve as venues for students and faculty members to engage in creative work and cutting-edge research.

VISION

To be the National Institute of Electrical, Electronics and Computer Engineering – internationally recognized; achieving national impact and global significance

MISSION

To produce innovative engineers who are committed to serve the nation; and to advance the field of electrical and electronics engineering

UNDERGRADUATE PROGRAMS

The Computer Engineering, Electrical Engineering, and Electronics and Communications Engineering undergraduate programs produce innovative engineers committed to serve the nation through the practice of the electrical and electronics engineering profession and its allied fields. The Bachelor of Science in Computer Engineering (BSCoE) program develops engineers who design and implement a broad spectrum of computing systems and components, ranging from integrated circuits, embedded systems, computer networks, and software applications. The Bachelor of Electronics and Communications Engineering (BSECE) program trains engineers who analyze, plan, design, measure, and operate electronic and communication

devices and systems. The Bachelor of Science in Electrical Engineering (BSEE) program produces engineers who model, analyze, plan, design, measure, operate, and control electric power systems. These three undergraduate programs work closely together to provide students a unique opportunity for cross-curricular learning from all of these areas while pursuing specific undergraduate degrees, enabling them to understand new, complex and hybrid systems, and allowing graduates to rapidly adapt to the continuously-changing technology landscape.

The curricula for the BSCoE, BSECE, and BSEE programs may be found in pages 10-12 of this Catalogue, while undergraduate course offerings may be found in page 18.

GRADUATE PROGRAMS

Our graduate programs provide the country with a pool of highly qualified electrical and electronics engineers who carry out creative and challenging work in research, development, design, technology management and university instruction.

The Master of Science (MS) program is a research-oriented degree program targeted primarily at academics and researchers. Prospective students in this program intend to undertake research towards enhancing the delivery of higher education in academic institutions or the development of new technology in government and industry research institutions. MS students undergo coursework and get trained in research through immersion in research laboratories, and write a thesis documenting the findings and contributions from their research work.

The Master of Engineering (ME) program offers an advanced professional degree targeted primarily at industry practitioners and professionals. Prospective students in this program seek enhance their skills and knowledge for career advancement and towards supporting higher value engineering activities in their respective institutions. As such, the program supports the development of local engineering industry by enhancing the capability of its workforce to undertake higher value engineering work. ME students may flexibly tailor their coursework based on their learning or professional objectives: they may even opt to engage in research work, directed study, or project work within their program of study.

The Doctor of Philosophy (PhD) and Doctor of Engineering (DE) programs produce experts capable of conducting independent investigation and study, producing original contributions to the fundamental knowledge in the field (PhD), or solving engineering problems of substance and developing solutions in a creative and distinguished manner (DE). Doctoral students undergo an intensive program of study and research in exciting, cutting-edge areas of technology, and write a dissertation documenting their journey and findings from their investigation. Although the typical

entrance credential for admission into the doctoral programs is a master's degree in a relevant field, admission is also possible for exceptional candidates who possess a relevant bachelor's degree.

Curricula for the graduate programs may be found in pages 16-17 of this Catalogue, while graduate course offerings may be found in page 23.

RESEARCH AREAS AND LABORATORIES

The research areas of faculty members and students cover a wide range of topics which includes microelectronics, digital signal processing, software engineering, computer systems and networks, instrumentation and control, robotics, power electronics, power systems and renewable energy systems, among others. Below are the research laboratories, each with specific line of research interest:

UP-Analog Devices Microelectronics and Microprocessors Laboratories I and II (MicroLab)

Lab heads:

Dr. Louis P. Alarcon and Dr. Ma. Theresa G. de Leon

The MicroLabs are used for research in the design and development of radio-frequency CMOS integrated circuits, analog/mixed signal systems, and low-power microprocessors.

UP-Artсын Power Electronics Laboratory (PEL)

Lab head: Dr. Carl Michael F. Odulio

This laboratory serves as a training ground to expose students to the various fields of power electronics. PEL research areas include power supplies and converters, electric vehicle charging, electric motor drives, LED lighting, power amplifiers, battery technology, and electromagnetic compatibility.

Computer Networks Laboratory (CNL)

Lab head: Dr. Roel M. Ocampo

Research under this laboratory covers various rapidly-evolving aspects and applications of communication networks including but not limited to mobile systems, social networks, application-layer overlays, novel link/ routing/ transport protocols, cooperative community networks, low-overhead computing and networking, smart grids and smart homes, sensor networks, the Internet of Things (IoT), and big data.

Digital Signal Processing (DSP) Laboratory

Lab head: Engr. Michael Gringo Angelo R. Bayona

Research in the DSP Laboratory is geared towards DSP algorithm development and implementation. Areas of concentration include software and hardware embedded systems for real-time and non-

real-time applications in audio, image, video and speech signal processing.

Electric Power Research Laboratory (EPRL)

Lab head: Dr. Allan C. Nerves

The EPRL is dedicated to research aimed at providing a safe, reliable, and optimum generation, distribution, conversion, measurement, and control of electric energy. Areas of concentration include modeling and simulation of electricity markets and power system dynamics; security assessment and stability enhancement for power systems in the restructured environment; and power system planning and optimal operation that ensure supply security, market competitiveness, and environmental sustainability.

Mobile Robotics (Mobot) Laboratory

Lab head: Engr. Percival D.C. Magpantay

This laboratory focuses on mobile robots and intelligence agents. Research thrusts include almost every aspect of electrical engineering, e.g. power electronics, instrumentation and control communications, embedded systems, artificial intelligence, and operating systems; and a little of computer science, mechanics, biology, and philosophy.

Innovation Research Center (IRC)

Lab head: Dr. Luis G. Sison

The research facility provides technology solutions in managing production resources, health care, and education. Its research thrusts are biomedical engineering; traffic, structural, and environmental monitoring; wireless sensor networks and embedded systems and mechatronics; and hardware interfaces for interactive learning.

Power Simulations Systems Laboratory (PSSL)

Lab head: Dr. Jordan Rel C. Orillaza

Research areas include modeling, simulation, and optimization of electric power systems (reliability); and planning, protection, automation, control and power quality. The lab is equipped with power system simulation software and hardware simulators such as power system micro-models fitted with protective relays, remote terminal units (RTUs), and supervisory control and data acquisition (SCADA).

Robotics Automation Laboratory (RAL)

Lab head: Dr. Manuel C. Ramos, Jr.

This laboratory focuses on robotic manipulators, bipeds, and autonomous navigation. Research topics under RAL may include, but not limited to manipulator dynamics, motor drives, sensor development, and autonomous vehicles.

Smart Grid Research Center (SGRC)

Lab head: Dr. Michael Angelo A. Pedrasa

Research areas include design and implementation of smart grid building blocks; control and communication solutions for smart grids; demand side management; integration of renewable and distributed energy resources to electric power systems; microgrids; virtual power plants; smart buildings and smart homes; and regulatory aspects and market operations for smart grid.

Solar Photovoltaics Laboratory (SPL)

Lab head: Dr. Lew Andrew R. Tria

As one of the leading research institutions for renewable energy research in the country, the SPL is continuously striving to develop, innovate, and promote novel energy technologies in order to uplift the quality of life for Filipino society and to safeguard the environment. Since its inception, the SPL has continually developed its expertise in many fields of renewable energy, advocates sustainable development, and the judicious use of energy resources through the implementation of its projects and programs.

Ubiquitous Computing Laboratory (UCL)

Lab head: Dr. Rowel O. Atienza

The UCL focuses on mobile, wearables and Internet of Things (IoT) research. This lab innovates on areas such as educational games (eg Animated Star Gram), human-device interaction (Slash the Fruit, Alien Antics and Holy Sheep!), virtual reality, animation, IoT protocols, and smart apps.

Wireless Communications Engineering Laboratory (WCEL)

Lab head: Engr. Neil Irwin M. Bernardo

The WCEL was established to provide instructional and training support, as well as to spearhead the research and development efforts of the Institute in the area of wireless communications technology. The lab primarily engages in the design, integration, analysis, and testing of wireless communication devices, circuits, and systems for various applications such as rural connectivity, emergency response, and public safety.

INSTRUCTIONAL FACILITIES

The Institute provides a wide range of facilities to support the instructional and research needs of its students, ranging from the 240-seater PLDT Multimedia Lecture Hall, numerous lecture rooms of various sizes, all the way down to meeting facilities for small group discussions. Students are also provided a number of areas for their own use where they can study, relax, or hold small discussions. Graduate students are also

provided dedicated office spaces in addition to their work spaces in the laboratories.

The EEEI complements solid theoretical training with exposure and actual hands-on work in instructional laboratories on electronic components and circuits, embedded systems, communication systems, electric machines and motor drives, power system simulation, robotics and automation, prototyping, computer programming and computer networks. Many of these facilities are supported and endowed with state-of-the-art and industry-grade equipment by partners such as Alexan, Analog Devices, Artesyn, Intel, IXYS-Zilog, Meralco, PLDT, and Nokia, to name a few. These facilities ensure that students acquire sufficient practical skills in the design, implementation, operation and management of similar components or systems, making them "industry-ready" and well-prepared to solve engineering challenges out in the real world.

FACULTY AND STAFF

To date, the Institute has 48 full-time faculty members (9 on study leave), 27 lecturers, 1 Teaching Fellow, 4 Teaching Associates, and 7 regular staff.

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UNDERGRADUATE PROGRAMS CURRICULA

BACHELOR OF SCIENCE IN COMPUTER ENGINEERING, 2015[†]

First Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
(AH1) Eng 10 (College Eng)	None	None	3	0	3	(AH2) Comm 3 (Prac.Speech Fund.)	None	None	3	0	3
(SSP1) Philo 1 (Philosophical Analysis)	None	None	3	0	3	Physics 71 (Elem Phys I)	None	Math 53	4	0	4
(SSP 2) Kas 1 ¹ (Kasaysayan ng Pilipinas)	None	None	3	0	3	Math 53 (Elem Analysis I)	Math 17/equiv	None	5	0	5
Math 17 (Algebra & Trigo)	1yr HS algeb	None	5	0	5	EEE 11 (Prog Fund)	Math 17	None	2	3	3
Chem 16 (Gen.Chem.1)	None	Math11/equiv	3	6	5	EEE 31 (Intro to EEE)	Math 17	None	3	0	3
PE					(2)	PE					(2)
			17	6	19				17	3	18
Second Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
Math 54 (Elem Analysis II)	Math 53	None	5	0	5	Math 55 (Elem Analysis III)	Math 54	None	3	0	3
Physics 72 (Elem Phys II)	Phys 71	None	4	0	4	Math 114 (Linear Alegbra)	Math 54/equiv	None	3	0	3
EEE 13 (Prog Appl in EEE)	EEE 11	None	2	3	3	ES 1 (Engg Drawing)	None	None	0	6	2
EEE 21 (Sw Theo & Dig Log Des)	Math 17	None	3	0	3	ES 11 (Statics of Rigid Bod)	Math 54	None	2	3	3
EEE 33 (Elect Circuit Theory)	EEE 31, Math 53	None	4	0	4	EEE 23 (Electromag Fields I)	Phys 72	Math 55	4	0	4
EEE 34 (Elect Meas Lab)	None	EEE 33	0	3	1	EEE 35 (Signals & Systems)	EEE 11, EEE 33, Math 54	None	3	3	4
PE					(2)	PE					(2)
NSTP ⁴					(3)	NSTP ⁴					(3)
			18	6	20				15	12	19
Third Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
(MST1) STS (Scie Tech & Society)	None	None	3	0	3	(AH3) Fil 40 ¹ (Wika, Kultura, at Lipunan)	None	None	3	0	3
ES 12 (Dynamics of Rigid Bod)	ES 11	None	2	3	3	EEE 51 (Electronic Circ I)	EEE 41	None	3	0	3
EEE 25 (Prob&Stat for EEE)	Math 55	None	3	0	3	EEE 52 (Electr Circ Lab I)	EEE 42	EEE 51	0	3	1
EEE 41 (Intro to Semicon Dev& Circ Lab)	EEE 23, EEE 33	None	3	0	3	EEE 53 (Electronic Circ II)	EEE 21, 41	None	3	0	3
EEE 42 (Semicon Dev and Circ)	EEE 34	EEE 41	0	3	1	EEE 100 (Electr Circ Prototyp Lab)	ES 1, EEE 42	None	0	3	1
EEE 43 (Electromech Egy Conv)	EEE 23, 33	None	3	0	3	EEE 101 (Control Sys Theo)	EEE 35, ES 12	EEE 41	3	0	3
CoE 23 (Syn of Seq Cir)	EEE 11, 21, 34	None	2	3	3	EEE 105 (Computer Org)	EEE 11, 21, 41	None	3	3	4
			16	9	19				15	9	18
Fourth Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
(MST 2) ³ Free Choice	None	None	3	0	3	(SSP 3) Free Choice	None	None	3	0	3
EEE 54 (Electr Circ Lab II)	EEE 42	EEE 53	0	3	3	CoE 113 (Adv Comp Org)	CoE 111, EEE 105	None	3	3	4
EEE 107 (Intro to Comm Syst)	EEE 25, 34, 35	None	2	3	3	CoE 115 (Intro to Embedded μ C)	EEE 105	None	2	3	3
CoE 111 (Adv Digital Design)	None	CoE105	2	3	3	CoE 134 (Comp Sys Eng II)	CoE 133	None	1	3	2
CoE 133 (Comp Sys Engg I)	EEE 105	None	2	0	2	CoE 151 (Comp Networks)	EEE 13, 107	None	3	3	4
CoE 135 (Operating System)	EEE 13	None	2	3	3						
Elective					3						
			8	12	18				9	12	16
Fifth Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
(AH 4) ² Free Choice	None	None	3	0	3	(SSP 5) Free Choice	None	None	3	0	3
(SSP 4) Free Choice	None	None	3	0	3	(AH 5) ² Free Choice	None	None	3	0	3
PI 100 (Life & Works of Rizal)	60 units passed	None	3	0	3	(MST 3) ³ Free Choice	None	None	3	0	3
CE 22 (Engg Economy)	4 th yr standing	None	3	0	3	CoE 198 (Special Prob CoE)	Proj Prop Lab aff	None	2	9	5
EEE 190 (Proj Prop, Ins Tr Sem)	Senior, lab aff	None	1	3	2	Elective	None	None	3	0	3
Elective					3						
			13	3	17				14	9	17
Total Number of Units = 181											

NOTES:[†] Effective AY 2010-2011. Total number of units = 181¹ Kas 1 and Fil 40 satisfy the 6-unit Philippine Studies requirement² Minimum of nine (9) units of English/Communication courses must be taken³ Except for Math 1, RGEF courses in the MST domain must NOT be under Physics, Chemistry, or Mathematics⁴ As a requirement for graduation, all students are required to take one (1) year program in one of the following components: (a) Military Training Service (ROTC); (b) Civic Welfare

Training Service (CWTS); (c) Literacy Training Service

⁵ CoE 111, 121, 123, 127, 129, 131, 133, 134, 141, 143, 153, 197; ECE 123, 129, 131,

133, 153, 155, 157, 159, 197

⁶ Must have taken EEE 51, EEE 101, EEE 105, and EEE 107**BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING, 2015[†]**

First Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
(AH1) Eng 10 (College Eng)	None	None	3	0	3	(AH2) Comm 3 (Prac.Speech Fund.)	None	None	3	0	3
(SSP1) Philo 1 (Philosophical Analysis)	None	None	3	0	3	Physics 71 (Elem Phys I)	None	Math 53	5	0	5
(SSP 2) Kas 1 ¹ (Kasaysayan ng Pilipinas)	None	None	3	0	3	Math 53 (Elem Analysis I)	Math 17/equiv	None	4	0	4
Math 17 (Algebra & Trigo)	1yr HS algeb	None	3	6	5	EEE 11 (Prog Fund)	Math 17	None	2	3	3
Chem 16 (Gen.Chem.1)	None	Math11/equiv	5	0	5	EEE 31 (Intro to EEE)	Math 17	None	3	0	3
PE	None	None			(2)	PE	None	None			(2)
			17	6	19				13	3	18
Second Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
Math 54 (Elem Analysis II)	Math 53	None	3	0	3	Math 55 (Elem Analysis III)	Math 54	None	4	0	4
Physics 72 (Elem Phys II)	Phys 71	None	2	3	3	Math 114 (Linear Alegbra)	Math 54/equiv	None	3	3	4
EEE 13 (Prog Appl in EEE)	EEE 11	None	4	0	4	ES 1 (Engg Drawing)	None	None	2	3	3
EEE 21 (Sw Theo & Dig Log Des)	Math 17	None	0	3	1	ES 11 (Statics of Rigid Bod)	Math 54	None	3	0	3
EEE 33 (Elect Circuit Theory)	EEE 31, Math 53	None	4	0	4	EEE 23 (Electromag Fields I)	Phys 72	Math 55	3	0	3
EEE 34 (Elect Meas Lab)	None	EEE 33	5	0	5	EEE 35 (Signals & Systems)	EEE 11, EEE 33, Math 54	None	0	6	2
PE					(2)	PE					(2)
NSTP ⁴					(3)	NSTP ⁴					(3)
			18	6	20				15	12	19
Third Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
(MST1) STS (Sci, Tech, and Society)	None	None	3	0	3	(AH 3) Fil 40 ¹ (Wika, Kultura, at Lipunan)	None	None	3	0	3
(SSP3) Free Choice	None	None	3	0	3	EE 143 (Elec'l Machine Dyn & Ctrl)	EEE 43	None	3	0	3
EEE 25 (Prob & Stat for E&E Engrs)	Math 55	None	3	0	3	EEE 44 (Elec'l Machine Op & Ctrl)	EEE 34	EEE 43	0	3	1
EEE 41 (Intro to Semicon Dev & Cir)	EEE 23, EEE 33	None	3	0	3	EEE 53 (Electr Circ II)	EEE 41, EEE 21	None	3	0	3
EEE 42 (Semicon Devices & Cir Lab)	EEE 34	EEE 41	0	3	1	EEE 54 (Electronic Circuits Lab II)	EEE 42	EEE 53	0	3	1
EEE 43 (Electromechanical Egy Conv)	EEE 23, EEE 33	None	3	0	3	EEE 100 (Elec Circuits Proto Lab)	ES 1, EEE 42	None	0	3	1
ES 12 (Dynamics of Rigid Bodies)	ES 11	None	2	3	3	EEE 101 (Control Syst Theo)	ES 12, EEE 35	None	3	0	3
						EEE 103 (Intro to Elec Power Sys)	EEE 23, EEE 33	None	3	0	3
			17	6	19				15	9	18
Fourth Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
(AH 4) ² Free Choice	None	None	3	0	3	EE 121 (Intro to Power Electronics)	EEE 42, EEE 53	None	2	3	3
EE 145 (Electrl Equip & Devices)	EEE 43, EEE 103	None	3	0	3	EE 153 (Electric Power Distn Systems)	EEE 103, EE 145	None	3	0	3
EE 146 (Elec'l Power Meas)	EEE 43, 44, 103	None	0	3	1	EEE 51 (Electr Circ I)	EEE 41	None	3	0	3
EEE 152 (Adv Power Systems Analysis)	EEE 13, 103	None	2	3	3	EEE 52 (Electr Circ Lab I)	EEE 42	EEE 51	0	3	1
EE 158 (Electrical System Design)	EEE 103	None	2	3	3	EEE 105 (Computer Org)	EEE 11, 21, 41	None	3	3	4
EEE 107 (Intro to Comm Systems)	EEE 23, 34, 35	None	2	3	3	ME 63 (Thermodynamics)	Phys 72, Math 54	None	3	0	3
Elective					3						
			12	12	19				14	9	17
Fifth Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
(SSP 4) Free Choice	None	None	3	0	3	(AH 5) ² Free Choice	None	None	3	0	3
(MST 2) ³ Free Choice	None	None	3	0	3	(SSP 5) Free Choice	None	None	3	0	3
CE 22 (Engineering Economy)	4thyr	None	3	0	3	(MST 3) ³ Free Choice	None	None	3	0	3
Physics 73 (Elem Physics III)	Phys 72	None	4	0	4	EE 198 (Special Prob EE)	proj rop, lab aff	None	2	9	5
EEE 190 (Project Proposals)	Lab aff	None	1	3	2	PI 100 (Life&Works of Rizal)	60 units passed		3	0	3
Elective					3						
			14	3	18				14	9	17
Total Number of Units = 184											

NOTES:¹ Effective AY 2010-2011. Total number of units = 181¹ Kas 1 and Fil 40 satisfy the 6-unit Philippine Studies requirement² Minimum of nine (9) units of English/Communication courses must be taken³ Except for Math 1, RGEF courses in the MST domain must NOT be under Physics, Chemistry, or Mathematics⁴ As a requirement for graduation, all students are required to take one (1) year program in one of the following components: (a) Military Training Service (ROTC); (b) Civic Welfare

Training Service (CWTS); (c) Literacy Training Service

⁵ CoE 111, 121, 123, 127, 129, 131, 133, 134, 141, 143, 153, 197; ECE 123, 129, 131,

133, 153, 155, 157, 159, 197

⁶ Must have taken EEE 51, EEE 101, EEE 105, and EEE 107**BACHELOR OF SCIENCE IN ELECTRONICS AND COMMUNICATIONS ENGINEERING, 2015[†]**

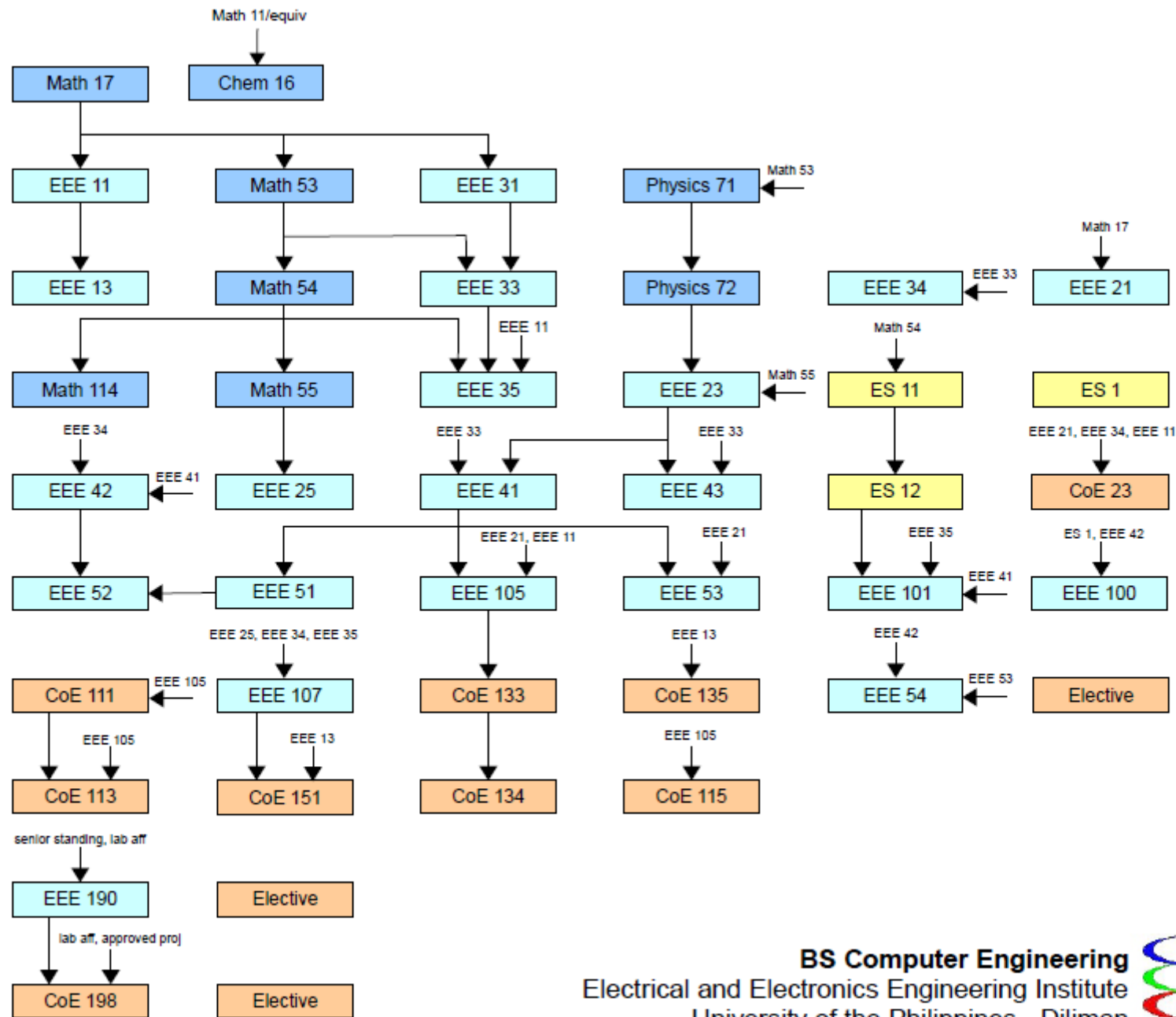
First Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
(AH1) Eng 10 (College Eng)	None	None	3	0	3	(AH2) Comm 3 (Prac.Speech Fund.)	None	None	3	0	3
(SSP1) Philo 1 (Philosophical Analysis)	None	None	3	0	3	Physics 71 (Elem Phys I)	None	Math 53	5	0	5
(SSP 2) Kas 1 ¹ (Kasaysayan ng Pilipinas)	None	None	3	0	3	Math 53 (Elem Analysis I)	Math 17/equiv	None	4	0	4
Math 17 (Algebra & Trigo)	1yr HS algeb	None	3	6	5	EEE 11 (Prog Fund)	Math 17	None	2	3	3
Chem 16 (Gen.Chem.1)	None	Math11/equiv	5	0	5	EEE 31 (Intro to EEE)	Math 17	None	3	0	3
PE	None	None			(2)	PE	None	None			(2)
			17	6	19				17	3	18
Second Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
(MST 1) STS (Sci, Tech, and Society)	None	None	3	0	3	EEE 23 (Electromag Flds I)	Phys 72	Math 55	4	0	4
EEE 13 (Programming Appl in EEE)	EEE 11	None	2	3	3	EEE 35 (Signals&Systems)	EEE 11, EEE 33, Math 54	None	3	3	4
EEE 33 (Electric Circuit Theory)	EEE 31, Math 53	None	4	0	4	ES 11 (Stats of Rigid Bodies)	Math 54	None	2	3	3
EEE 34 (Electrical Meas Lab)	None	EEE 33	0	3	1	Math 55 (Elem Analysis III)	Math 54	None	3	0	3
Physics 72 (Elem Physics II)	Phys 71	None	4	0	4	Physics 73 (Elem Physics III)	Phys 72	None	4	0	4
Math 54 (Elem Analysis II)	Math 53	None	5	0	5	PE					(2)
PE					(2)	NSTP ⁴					(3)
NSTP ⁴					(3)						
			18	6	20				16	6	18
Third Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
EEE 21 (Sw Theory & Dig Log Des)	Math 17	None	3	0	3	(AH) Fil 40 ¹ (Wika, Kultura, at Lipunan)	None	None	3	0	3
EEE 25 (Prob & Stat for E&E Engrs)	Math 55	None	3	0	3	EEE 51 (Electr Circ I)	EEE 41	None	3	0	3
EEE 41 (Intro Semicon Dev & Cir)	EEE 23, EEE 33	None	3	0	3	EEE 52 (Electr Circ Lab I)	EEE 42	EEE 51	0	3	1
EEE 42 (Semicon Devices & Cir Lab)	EEE 34	EEE 41	0	3	1	EEE 107 (Intro to Comm Systems)	EEE 25, 34, 35	None	2	3	3
EEE 43 (Electromechanical Egy Conv)	EEE 23, EEE 33	None	3	0	3	Math 114 (Linear Algebra)	Math 54/equiv	None	3	0	3
EEE 44 (Elctrl Machine Op & Ctrl)	EEE 34	EEE 43	0	3	1	ES 1 (Engineering Design)	None	None	0	6	2
ES 12 (Dynamics Rigid Bodies)	ES 11	None	2	3	3	ME 63 (Thermodynamics)	Phys 72, Math 54	None	3	0	3
			14	9	17				14	12	18
Fourth Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
ECE 141 (Digital Communications)	EEE 107	None	2	3	3	(SSP 3) Free Choice	None	None	3	0	3
EEE 53 (Electronics Circuits II)	EEE 41, EEE 21	None	3	0	3	ECE 113 (Comm Electronics)	EEE 53, 54, 100, 107	None	2	3	3
EEE 54 (Electronics Circuits Lab II)	EEE 42	EEE 53	0	3	1	CoE 115 (Intro to Embedded μ C)	EEE 105	None	2	3	3
EEE 100 (Elect Circuits Proto Lab)	ES1, EEE 11, 42	None	0	3	1	ECE 117 (Instrument'n Electronics)	EEE 34, 51	None	2	3	3
EEE 105 (Computer Organization)	EEE 11, 21, 41	None	3	3	4	ECE 151 (Comm Networks)	EEE 107	None	3	0	3
EEE 101 (Control System Theory)	EEE 35, ES 12	EEE 41	2	3	3	EEE 103 (Intro to Elec Power Sys)	EEE 23, 33	None	3	0	3
Elective ⁵					3						
			10	15	18				15	9	18
Fifth Year											
First Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Prereq	Coreq	Lect (hrs/wk)	Lab (hrs/wk)	Units
(SSP 4) Free Choice	None	None	3	0	3	(SSP 5) Free Choice	None	None	3	0	3
(AH 4) ² Free Choice	None	None	3	0	3	(AH 5) ² Free Choice	None	None	3	0	3
(MST 2) ³ Free Choice	None	None	3	0	3	(MST 3) ³ Free Choice	None	None	3	0	3
CE 22 (Engineering Economy)	4thyr	None	3	0	3	ECE 198 (Special Problems in ECE)	Proj prop Lab aff	None	2	9	5
EEE 190 ⁶ (Project Proposals)	Senior Lab aff	None	1	3	2	PI 100 (The Life and Works of Rizal)	60 units passed	None	3		3
Elective ⁵					3						
Elective ⁵					3				14	9	17
			13	3	20						
Total Number of Units = 183											

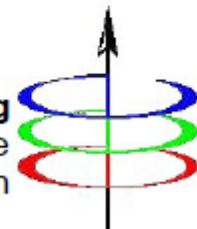
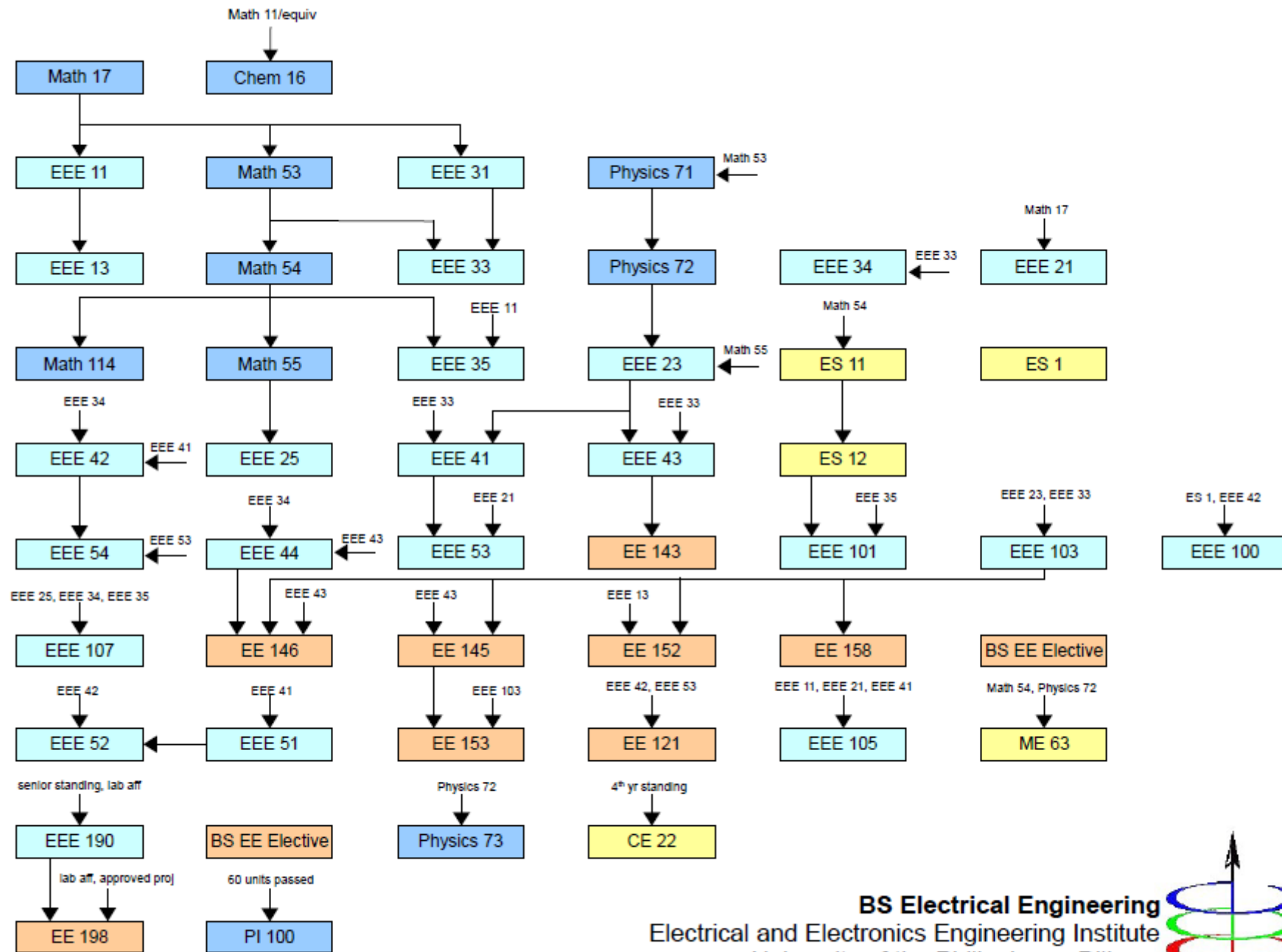
NOTES:¹ Effective AY 2010-2011. Total number of units = 181² Kas 1 and Fil 40 satisfy the 6-unit Philippine Studies requirement³ Minimum of nine (9) units of English/Communication courses must be taken⁴ Except for Math 1, RGEP courses in the MST domain must NOT be under Physics, Chemistry, or Mathematics⁵ As a requirement for graduation, all students are required to take one (1) year program in one of the following components: (a) Military Training Service (ROTC); (b) Civic Welfare

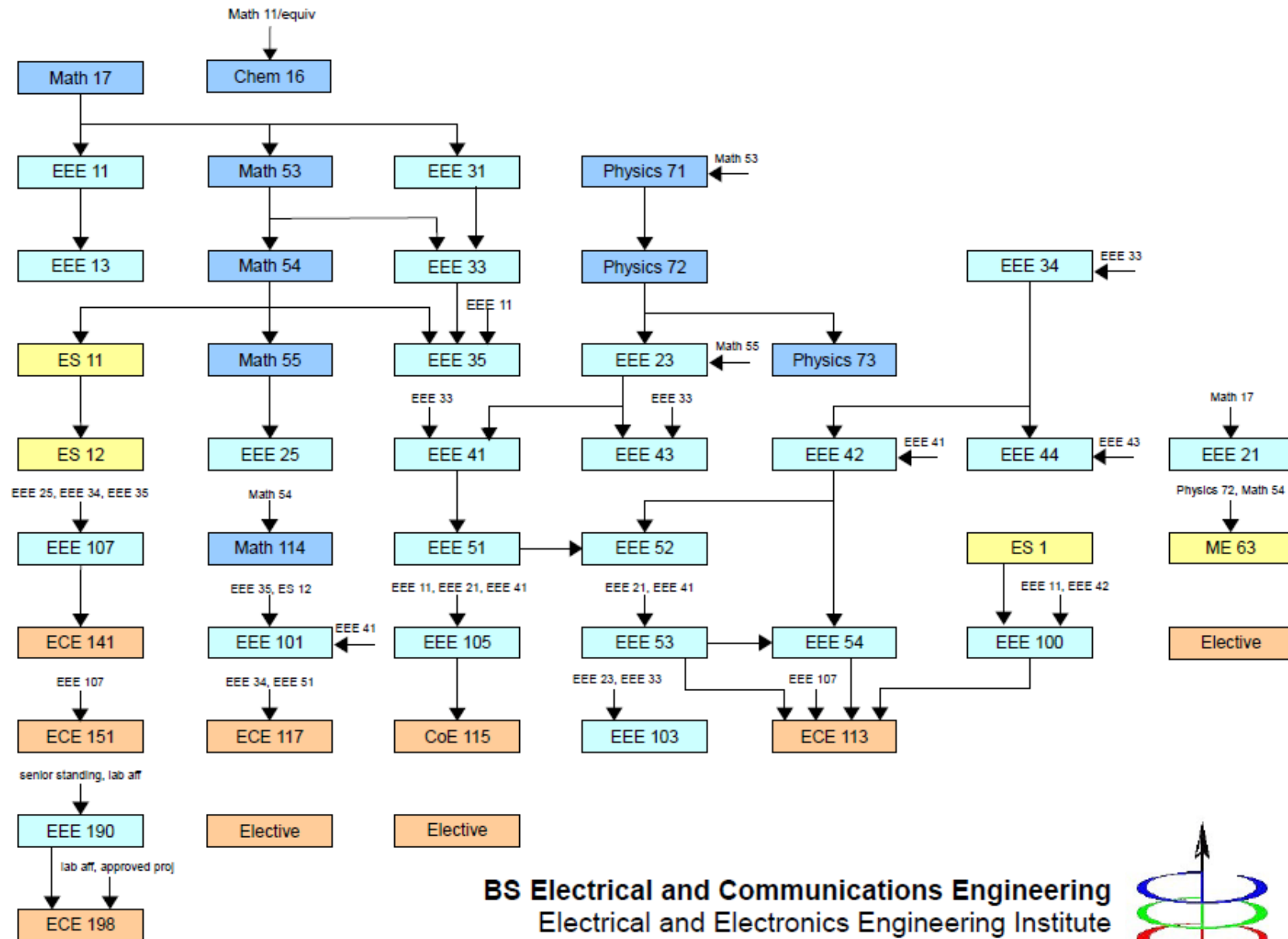
Training Service (CWTS); (c) Literacy Training Service

⁵ CoE 111, 121, 123, 127, 129, 131, 133, 134, 141, 143, 153, 197; ECE 123, 129, 131, 133, 153, 155, 157, 159, 197

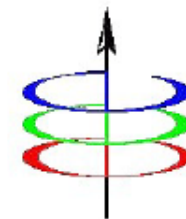
⁶ Must have taken EEE 51, EEE 101, EEE 105, and EEE 107







BS Electrical and Communications Engineering
 Electrical and Electronics Engineering Institute
 University of the Philippines - Diliman



GRADUATE PROGRAMS CURRICULA**Master of Engineering in Electrical Engineering (M.E. EE)**

PROGRAM CHECKLIST

A. Required Major Courses ¹	15 units
B. Elective Courses ²	14 units
C. Comprehensive Examination	
D. Seminar Course	
• EE 296 Seminar	1 unit
TOTAL	30 units

NOTES:

1. Major Subject: Any creditable graduate-level EE course offered by the EEE Institute that is relevant to the area of specialization.
2. Elective: Any creditable graduate-level course that has been recommended for approval by the adviser and Institute graduate program committee; provided that all course prerequisites have been satisfied.

Master of Science in Electrical Engineering (M.S. EE)

PROGRAM CHECKLIST

A. Required Major Courses ¹	14 units
B. Elective Courses ²	9 units
C. Thesis	
• EE 300	6 units
D. Seminar Course	
• EE 296 Seminar	1 unit
TOTAL	30 units

NOTES:

1. Major Subject: Any creditable graduate-level EE course offered by the EEE Institute that is relevant to the area of specialization.
2. Elective: Any creditable graduate-level course that has been recommended for approval by the adviser and Institute graduate program committee; provided that all course prerequisites have been satisfied.

**Doctor of Engineering in Electrical and Electronics Engineering (D.E. EEE)
Doctor of Philosophy in Electrical and Electronics Engineering (Ph.D. EEE)**

PROGRAM CHECKLIST

A. Major ¹ or Specialization ² Courses	24 units
B. Dissertation ³	
• EE 400	12 units

Notes:
* For MS/ME degree holders
¹Major Course: Any creditable Electrical and Electronics Engineering graduate course relevant to the field / area of specialization
²Specialization Course: Any creditable graduate course relevant to the field of specialization, pre-approved by the adviser and for which all prerequisites have been satisfied
³The student must submit a 12-unit dissertation where s/he makes an original contribution to the fundamental knowledge in the field (PhD) or addresses an engineering problem of substance and develops a solution in a creative and distinguished manner (DE)

**Doctor of Engineering in Electrical and Electronics Engineering (D.E. EEE)
Doctor of Philosophy in Electrical and Electronics Engineering (Ph.D. EEE)**

PROGRAM CHECKLIST

A. Major ¹ Courses	24 units
B. Specialization Courses ²	12 units
C. Applied Mathematics	9 units
D. Dissertation ³	
• EE 400	12 units

Notes:
*For BS degree holders
¹Major Course: Any creditable Electrical and Electronics Engineering graduate course relevant to the field / area of specialization
²Specialization Course: Any creditable graduate course relevant to the field of specialization, pre-approved by the adviser and for which all prerequisites have been satisfied
³The student must submit a 12-unit dissertation where s/he makes an original contribution to the fundamental knowledge in the field (PhD) or addresses an engineering problem of substance and develops a solution in a creative and distinguished manner (DE)

UNDERGRADUATE PROGRAMS COURSE DESCRIPTIONS

Computer Engineering (CoE)

- 23 Synthesis of Sequential Circuits.** Minimization of synchronous sequential circuits; synthesis of synchronous sequential circuits using structured techniques; delays & hazards; asynchronous Huffman circuits; physical characteristics of logic gate implementations. *Prereq:* EEE 11, EEE 21, EEE 34. 5 h (2 lec, 3 lab). 3 u.
- 111 Advanced Digital Design.** Combinational & sequential circuits; structured design; digital design using programmable devices; hardware description language (HDL)-based digital design; simulation; testing of digital circuits. *Coreq:* EEE 105. 5 h (2 lec, 3 lab). 3 u.
- 113 Advanced Computer Organization.** Instruction sets. Central processor implementations. Hardwired and microprogrammed control. Reduced instruction set computer (RISC) processors. Datapaths. Arithmetic and logic units (ALUs). Distributed systems. Performance enhancements. *Prereq:* CoE 111, EEE 105. 6 h (3 lec, 3 lab). 4 u.
- 115 Introduction to Embedded Microcontrollers.** Introduction to embedded microcontrollers in electronic and electromechanical systems. Hardware and software design techniques. System interfaces, data acquisition and control. High speed design techniques. *Prereq:* EEE 105. 5 h (2 lec, 3 lab). 3 u.
- 121 Introduction to Digital Signal Processing.** Discrete-time systems in frequency domain; digital filter design; linear prediction & optimum linear filters. *Prereq:* EEE 25, EEE 35. 6 h (3 lec, 3 lab). 4 u.
- 123 Introduction to Digital Image & Video Processing.** Digital image fundamentals; introduction to two-dimensional digital signal processing (DSP); image enhancements & restoration algorithms; image filters; image coding & compression; video coding & standards; some applications of video & image processing. *Prereq:* EEE 35. 6 h (3 lec, 3 lab). 4 u.
- 127 Audio & Speech Signal Processing.** Fundamental audio synthesis concepts; advanced techniques of audio signal processing, analysis & modeling; engineering models for speech signal analysis, synthesis & recognition. *Prereq:* CoE 121. 5 h (2 lec, 3 lab). 3 u.
- 129 Real-Time Digital Signal Processing.** Digital signal processor architectures; data converters; real-time concepts & programming; digital filtering; real-time spectral analysis. *Prereq:* CoE 121, EEE 105. 5 h (2 lec, 3 lab). 3 u.
- 133 Computer Systems Engineering I.** History and overview of computer systems engineering. Computer engineering ethics. Software risks and reliability. Life cycles. Project management. *Prereq:* EEE 105. 2 u.
- 134 Computer Systems Engineering II.** Requirements analysis and elicitation. Architectural design. Implementation, testing and maintenance issues. *Prereq:* CoE 133. 4 h (1 lec, 3 lab) 2 u.
- 135 Operating Systems.** Overview and examples of operating systems. System calls. Process management. Threads. Scheduler. Interprocess communication and synchronization. Deadlock and starvation. Memory management. Virtual memory. I/O systems. File system. *Prereq:* EEE 13. 5 h (2 lec, 3 lab). 3 u.
- 141 Introduction to Digital Integrated Circuit Design.** Concepts, economics & trends of integrated circuits (IC); MOS transistor characteristics & models; basic digital building blocks; structured digital circuits & systems. *Prereq:* EEE 21, EEE 41. 6 h (3 lec, 3 lab). 4 u.
- 143 Introduction to Analog Integrated Circuit Design.** IC fabrication processes; analog device modeling; circuit simulation; amplifiers, comparators & other analog systems. *Prereq:* EEE 51. 6 h (3 lec, 3 lab). 4 u.
- 151 Computer Networks.** Principles and practices of computer networking. Structures and components of networks. Packet switching. Layered architectures. Open systems interconnect (OSI) reference model. Transmission Control Protocol / Internet Protocol (TCP/IP). *Prereq:* EEE 13, 107. 6 h (3 lec, 3 lab) 4 u
- 153 Advanced Computer Networks.** Advanced topics in computer networks, including Internet architecture and design, multicast and advanced routing. Quality of service and congestion control. Network measurement and modeling. Mobile and ad-hoc networks. Web technologies and the Semantic Web. Application-layer overlay networks. Security and privacy. Emerging applications. *Prereq:* CoE 151. 5 h (2 lec, 3 lab). 3 u.

- 197 Special Topics in Computer Engineering.** *Prereq:* COI. 2-4 u. (any combination of lec or lab); may be repeated for additional credit provided that the special topic should be indicated for record purposes.
- 198 Special Problems in Computer Engineering.** *Prereq:* Approved project proposal from EEE 190, research laboratory affiliation. 11 h (2 lec, 9 lab) 5 u.

Electronics & Communications Engineering (ECE)

- 113 Communication Electronics.** Resonant circuits and filters. Analog modulation and de-modulation circuits. Frequency synthesis and phase locked loops. Basic concepts in radio frequency (RF) circuit design. Other communications circuits. *Prereq:* EEE 53, EEE 54, EEE 100, EEE 107. 5 h (2 lec, 3 lab). 3 u.
- 117 Instrumentation Electronics.** Sensors in control systems; signal conditioning; data acquisition systems; actuators & controllers; industry standards. *Prereq:* EEE 34, EEE 51. 5 h (2 lec, 3 lab). 3 u.
- 123 Digital Instrumentation & Control Techniques.** A/D-D/A conversion; process control; fundamentals of robotics; data acquisition; real time applications. *Prereq:* EEE 101. 3 u.
- 129 Simulation & Control Laboratory.** System modeling; computer-aided control system design & computer simulation; op amps as feedback compensators; DC motor dynamics & control; closed-loop control & responses to step & ramp inputs. *Prereq:* EEE 52/COI, EEE 101. 5 h (2 lec, 3 lab). 3 u.
- 131 Introduction to Robotics.** Coordinate transformations; forward & inverse kinematics; manipulator dynamics; control of manipulators; path planning. *Prereq:* EEE 101, ES 12, ES 21/COI. 3 u.
- 133 Introduction to Mobile Robotics.** Mobile robot control. Software architectures. Interoceptive and exteroceptive sensors. Sensor interpretation. Map building and navigation. Mobile robot construction. *Prereq:* EEE 35, ES 12 and EEE 11 or COI. 5 h (2 lec, 3 lab). 3 u.
- 141 Digital Communications.** Sampling & quantization; baseband pulse transmission; multiplexing; digital modulation techniques; bit error rates & spectral efficiency; clock recovery; information theory & error control coding; spread spectrum modulation. *Prereq:* EEE 107. 5 h (2 lec, 3 lab). 3 u.
- 151 Communication Networks.** Telephony; telephone traffic, switching & signaling systems; multiplexing; trunking theory; modem standards; optical communication systems; open systems interconnect (OSI) layers for communication systems. *Prereq:* EEE 107. 3 u.
- 153 Wireless Communications.** Radiowave propagation; antenna basics; large-scale path loss models; small-scale fading; cellular & satellite communication systems; multiple access techniques; current topics of interest in wireless communications. *Prereq:* EEE 23; *Coreq:* ECE 141. 3 u.
- 155 Modern Audio Engineering.** Fundamentals of sound & hearing; audio tests & measurements; electrical & environmental noise & noise reduction in audio systems; microphones & loudspeakers; audio processing electronics & acoustics; practical audio systems. *Prereq:* EEE 107. 5 h (2 lec, 3 lab). 3 u.
- 157 Microwave Engineering I.** Review of electromagnetics; transmission line theory & wave-guides; the Smith chart; network analysis & port parameters; impedance matching; passive & active microwave circuits. *Prereq:* EEE 23, EEE 107. 3 u.
- 159 Microwave Engineering II.** Microwave materials & processes; laminates; metals; solders; packaging; connectors; resistance, inductance, & capacitance (RLC) measurements; trans-mission lines; microstrip circuits; test & measurement equipment & software for microwave communication systems. *Prereq:* ECE 157, EEE 100. 5 h (2 lec, 3 lab). 3 u.
- 197 Special Topics in Electronics & Communications Engineering.** *Prereq:* COI. 2-4 u. (any combination of lec or lab); may be repeated for additional credit provided that the special topic should be indicated for record purposes.
- 198 Special Problems in Electronics & Communications Engineering.** *Prereq:* Approved project proposal from EEE 190, research laboratory affiliation. 11 h (2 lec, 9 lab). 5 u.

Electrical Engineering (EE)

- 121 Introduction to Power Electronics.** Switching converter principles, harmonics, pulse-width modulation, phase control and phase modulation. Single-phase and three-phase rectifiers. AC voltage controllers, DC/DC converters and DC/AC inverters. Converter transfer functions. *Prereq:* EEE 42, EEE 53. 5 h (2 lec, 3 lab). 3 u.
- 123 Electric Motor Drives.** Electric drive systems; steady-state analysis of direct current, induction, synchronous, & reluctance motor drives; efficiency, harmonics, & converter-motor interaction. *Prereq:* EE 121, EEE 43. 3 u.
- 143 Electrical Machine Dynamics and Control.** Dynamic models and characteristics of electrical machines. Applications and control of direct-current, synchronous, induction and reluctance machines. *Prereq:* EEE 43. 3 u.
- 145 Electrical Equipment and Devices.** Operating principles, characteristics and applications of transformers, switchgear, and other electrical equipment and devices used for power system protection and control. *Prereq:* EEE 43, EEE 103. 3 u.
- 146 Electric Power Measurements & Equipment Characterization.** Power measurements. Performance evaluation and parameter measurement of electrical machines and transformers. *Prereq:* EEE 43, EEE 44, EEE 103. 3 h (3 lab) 1 u.
- 147 Energy-efficient Lighting Systems.** Fundamentals of lighting, vision, and color. Electric light source and ballast technologies. Luminaires and optical control. Light loss factors. Average illuminance calculations. Calculation of illuminance at a point. Lighting quantity and quality assessment. Design of energy-efficient lighting for interiors. Design of energy-efficient lighting for exteriors. Strategies and technologies for control of energy-efficient lighting. Daylighting. Building energy codes and standards. Lighting economics. *Prereq:* EEE 41, EEE 101. 3 u.
- 148 Electrical Machine Design.** Design of transformers, rotating machines, and selected electrical equipment and devices. *Prereq:* EEE 143. 3 u.
- 151 Power System Operation.** Philippine Grid Code. Voltage and frequency control. Operating reserve. Unit commitment. Economic dispatch. Optimal power flow. Energy interchange. System security and reliability. Transmission network operations in competitive electricity markets. *Prereq:* EEE 103. 5 h (2 lec, 3 lab). 3 u.
- 152 Advanced Power Systems Analysis.** Large-scale power system studies using computer methods: matrix techniques and numerical methods. Network building. Load flow studies, fault studies and rotor angle stability. Electromagnetic transients analysis. *Prereq:* EEE 13, EEE 103. 5 h (2 lec, 3 lab). 3 u.
- 153 Electric Power Distribution Systems.** Substation, subtransmission and distribution system design. Distribution system models and load flow, short-circuit, reliability, and system loss analysis. Distribution planning. Distribution automation. *Prereq:* EE 103, EEE 145. 3 u.
- 157 New Energy Systems.** Non-conventional energy resources & conversion technologies; new energy systems for off-grid applications; grid integration issues of non-conventional & new energy systems; planning & operations of electric power systems with intermittent energy systems. *Prereq:* EEE 103. 3 u.
- 158 Electrical System Design.** Choice of systems & selection, arrangement & protection of components for power, lighting & auxiliary systems of residential, institutional, commercial, & industrial power systems; illumination design. *Prereq:* EEE 103. 5 h (2 lec, 3 lab). 3 u.
- 159 Industrial Power Systems.** Selection & arrangement of electrical equipment for distribution, control, protection & metering in industrial plants, substations & modern power plants. *Prereq:* EEE 158. 5 h (2 lec, 3 lab). 3 u.
- 197 Special Topics in Electrical Engineering.** *Prereq:* COI. 2-4 u. (any combination of lec or lab); may be repeated for additional credit provided that the special topic should be indicated for record purposes.
- 198 Special Problems in Electrical Engineering.** *Prereq:* Approved project proposal from EEE 190, research laboratory affiliation. 11 h (2 lec, 9 lab). 5 u.

Electrical & Electronics Engineering (EEE)

- 1 Essentials of Electrical & Electronics Engineering.** Analysis of alternating current (AC) & direct current (DC) circuits; motors & generators, characteristics & methods of control; diode & transistor circuits; current digital circuits & logic gates; transducers & transducer circuits; operational amplifiers; motor control; feedback control systems; introduction to digital control; programmable logic controllers. *Prereq:* ES 21/Math 121.1/equiv, Physics 72/102. 6 h (3 lec, 3 lab). 4 u.
- 3 Elementary Electrical Engineering.** Fundamentals of electric & magnetic circuits; transformers; direct & alternating current machinery; elementary distribution systems & electrical wiring. *Prereq:* Math 54, Physics 72. 3 u.
- 4 Industrial Electronics and Equipment.** Electrical measurements and some of their industrial applications. Operating principles, characteristics and application of electrical equipment. Equipment and devices used for system protection and control. Applications in power and industrial systems. Modern control devices in industry. *Prereq:* EEE 1 or EEE 3. Credits: 5 h (2 lec, 3 lab). 3 u.
- 5 Introduction to Semiconductor Devices and Circuit Theory.** Elementary circuit analysis; semiconductor devices; introduction to transducers, operational amplifiers, and digital design. *Prereq:* Math 54, Physics 72, Physics 72.1. 6 h (3 lec, 3 lab). 4 u.
- 7 Microcontroller-based Data Acquisition Systems.** Analog-to-digital conversion. Digital-to-analog conversion. Sensors and transducers. Signal conditioning. Data acquisition systems. Microcontroller programming and interfacing. Data transfer and visualization. *Prereq:* EEE 1 or EEE 3. 5 h (2 lec, 3 lab). 3 u.
- 11 Programming Fundamentals.** Programming fundamentals. Data types. Control loops. Fundamental principles of software engineering. Functions. Standard libraries. Arrays and strings. Structure and union. File I/O. Fundamental data structures. Pointers. *Prereq:* Math 17. 5 h (2 lec, 3 lab). 3 u.
- 13 Programming Applications in Electrical & Electronics Engineering.** Data structures. Algorithm performance. System calls. Fundamental database concepts. Graphical user interface principles. Fundamental network programming. *Prereq:* EEE 11 or equivalent. 5 h (2 lec, 3 lab). 3 u.
- 21 Switching Theory & Digital Logic Design.** Combinational logic analysis and design. Digital integrated circuit building blocks. Design of digital subsystems. Analysis and synthesis of sequential circuits. Introduction to hardware description languages. *Prereq:* Math 17. 3 u.
- 23 Electromagnetic Fields I.** Vector analysis; steady electric and magnetic fields; dielectric and magnetic materials; time-varying fields. Maxwell's equations; introduction to uniform plane waves & transmission lines; applications to electrical engineering. *Prereq:* Physics 72; *Coreq:* Math 55. 4 u.
- 25 Probability & Statistics for Electrical & Electronics Engineers.** Review of descriptive statistics; combinatorial probability; single & bivariate random variables; expectation; sum of two independent random variables; introduction to estimation; introduction to random processes. *Prereq:* Math 55. 3 u.
- 31 Introduction to Electrical & Electronics Engineering.** Fundamental concepts and laws in electrical and electronics engineering. Magnetism. Electrical and electronic devices. DC analysis of resistive networks. Overview of different fields in electrical and electronics engineering. Demonstration of basic concepts. *Prereq:* Math 17. 3 u.
- 33 Electric Circuit Theory.** Network theorems. AC circuit analysis. Equilibrium equations for resistance-inductance-capacitance (RLC) networks. Transient analysis of first-order and higher-order networks. Sinusoidal steady-state analysis. Polyphase circuits. *Prereq:* Math 53, EEE 31. 4 u.
- 34 Electrical Measurements Laboratory.** Laboratory procedures & practice; data collection & analysis; laboratory documentation; standard electric instruments & circuits; basic electric circuit behavior; transducers. *Coreq:* EEE 33. 3 h (lab) 1 u.
- 35 Signals and Systems.** Mathematical modeling of signals and systems. Continuous- and discrete-time signals. System analysis techniques and their applications to electric and electronic circuits, filter design, communications, control and signal processing. Linear time-invariant (LTI) systems. Frequency domain

representation of signals and system transfer functions. Two-port networks. Fourier-, Laplace- and Z-transforms. *Prereq:* Math 54, EEE 11, EEE 33. 6 h (3 lec, 3 lab). 4 u.

- 41 Introduction to Semiconductor Devices and Circuits.** Semiconductor devices: diodes, bipolar junction transistors, field effect transistors; device models & circuit applications; regions of operation; large & small signal modeling & analysis; semiconductor theory. *Prereq:* EEE 23, EEE 33, 3u
- 42 Semiconductor Devices and Circuits Laboratory.** Characteristics, parameters, & non-idealities of actual diodes, bipolar junction transistors (BJTs) & field effect transistors (FETs); basic circuit applications. *Prereq:* EEE 34; *Coreq:* EEE 41. 3 h (lab) 1 u.
- 43 Electromechanical Energy Conversion.** Basic principles; generalized machine model; direct current, synchronous & induction machines. *Prereq:* EEE 23, EEE 33. 3 u.
- 44 Electrical Machine Operation and Control.** Operation and control of rotating machines. Motor and generator control devices and circuits. Programmable logic controllers. *Prereq:* EEE 34, *Coreq.:* EEE 43, (3 lab) 1 u.
- 51 Electronic Circuits I.** Transistor amplifiers. Feedback amplifiers. Operational amplifiers. Linear regulators. *Prereq:* EEE 41. 3 u.
- 52 Electronic Circuits Laboratory I.** Performance measurements & behavior analysis of analog circuits. *Prereq:* EEE 42; *Coreq:* EEE 51. 1 u.
- 53 Electronic Circuits II.** Active switching circuits. Waveshaping circuits. Pulse and digital circuits. Analog and digital circuit building blocks. Linear and switch-mode regulators. *Prereq:* EEE 21, EEE 41. 3 u.
- 54 Electronic Circuits Laboratory II.** Construction, performance measurements and behavior analysis of pulse, wave-shaping, timing and digital circuits. *Prereq:* EEE 42; *Coreq:* EEE 53. 3 h (3 lab). 1 u.
- 100 Electronic Circuits Prototyping Laboratory.** Basic prototyping skills for electronic circuits including soldering, schematic design entry, printed circuit board (PCB) layout and routing, PCB fabrication. Safe laboratory practices. Computer aided design tools. Overview of industrial prototyping processes and standards. *Prereq:* ES 1, EEE 42. 3 h (3 lab). 1 u.
- 101 Control Systems Theory.** Continuous & discrete systems; open & closed loop systems; transfer functions; block diagrams. Signal flow graphs; state variables; state transition matrix; stability; controllability & observability. *Prereq:* ES 12, EEE 35; *Coreq:* EEE 41. 3 u.
- 103 Introduction to Electric Power Systems.** Electric power industry. Power system components and system modeling. Per unit system. Symmetrical components. Load flow analysis. Short circuit analysis. *Prereq:* EEE 23, EEE 33. 3 u.
- 105 Computer Organization.** Instruction sets. Computer arithmetic. Datapath and control. Memory system organization and architecture. Interfacing and communication. Assembly language programming. *Prereq:* EEE 11, EEE 21, EEE 41. 6 h (3 lec, 3 lab). 4 u.
- 107 Introduction to Communication Systems.** Signals & spectra; noise & distortion; transmission, reception, & detection; continuous-wave modulation & baseband digital pulse modulation; examples of practical communication systems. *Prereq:* EEE 25, EEE 34, EEE 35. 5 h (2 lec, 3 lab) 3 u.
- 190 Project Proposals, Inspection Trips, & Seminars.** Project proposal documentation & presentation; visits to companies, factories, & electrical power plants; seminars on topics such as research, technical writing, presentation skills, career planning, engineering ethics, & technopreneurship. *Prereq:* SS, research laboratory affiliation. 4 h (1 lec, 3 lab). 2 u.

REVITALIZED GENERAL EDUCATION COURSE

Electrical & Electronics Engineering (EEE)

- 10 Everyday EEE: Kuryente, Radyo, atbp.** Electrical & electronics engineering in everyday life. 3 u.

GRADUATE PROGRAMS COURSE DESCRIPTIONS

EE 212 Linear System Theory. Theory and application of discrete and continuous-time linear dynamical systems. Review of applied linear algebra; least-norm and least-squares methods. Autonomous linear dynamical systems; interpretations of eigenvalues, eigenvectors, matrix exponential, and invariant sets. Singular value decomposition with applications. Linear dynamical systems with inputs and outputs; transfer matrices. Observability and state estimation; controllability and state transfer. Examples and applications from digital filters, circuits, signal processing, and control systems. Prereq: EEE 35 and Math 114 or equiv. 5 h (2 lec, 3 lab) 3 u.

EE 214 Probability and Random Processes in Electrical Engineering. Review of combinatorial probability. Random variables and vectors. Discrete and continuous distributions. Conditional and multivariate probabilities. Functions of random variables. Mathematical expectations. Autocorrelation and power spectral density. Stochastic models. Stationarity and cyclostationarity. Higher order statistics, cumulants and polyspectra. Spectral-correlation density. Prereq: EEE 25 or equiv. 5 h (2 lec, 3 lab) 3 u.

EE 217 Electromagnetic Fields II. Review of Maxwell's equations. Propagation phenomena of plane waves in dielectric and conducting media. Transmission lines, waveguides and resonators. Antennas and radiation. Fiber optics and optoelectronic systems. Prereq EEE 23 or equiv. 3 u.

EE 218 System Identification. Introduction to point estimation, least squares, Bayes risk, and maximum likelihood. Optimum mean-square recursive estimation for non-dynamic stochastic systems. State estimation for discrete-time and continuous-time dynamic systems. Parameter identification of stochastic systems using maximum likelihood. Stochastic approximation, least squares, and random search algorithms. Applications to controls, communication, and signal processing. Prereq: EE 212 and EE 214. 3 u.

EE 220 Analog Integrated Circuits. Integrated circuit devices and modeling. Noise analysis and modeling. Review of basic operational amplifier design and compensation. Advanced current mirrors and operational amplifiers. Operational transconductance amplifiers. Common-mode feedback circuits. Comparators. Sample and holds. Voltage references and translinear circuits. Discrete-time signals. Switched-capacitor circuits. Co-req: CoE 143 or equiv. 6h (3 lec, 3 lab) 4 u.

EE 221 Electronic Amplifier Design. Linear and non-linear models of field-effect and bipolar junction transistors at low and high frequencies; theory, design and application of class A, B, C, D, E, F amplifiers, wide band low-pass amplifiers, distributed amplifiers, power amplifiers, tuned amplifiers, feedback amplifiers, operational amplifiers, parametric amplifiers, sense amplifiers, and other special amplifiers; biasing; gain-bandwidth; noise mechanisms and low-noise design; passive components; performance evaluation and optimization; integrated circuit implementations; design projects. Prereq: COI. 4 u.

EE 223 Design of Signal Processing Systems. System modeling. Computational algorithms. Architecture mapping. Hardware optimizations. SoC applications. Prereq: EE 227 and EE 274. 3 u.

EE 224 Mixed Signal Systems. Signals and filters. Sampling and aliasing. Analog and digital filters. Analog-to-digital converters. Digital-to-analog converters. Sample/hold amplifiers. Mixed-signal applications. Prereq: EE 220. 5 h (2 lec, 3 lab) 3 u.

EE 225 Solid State Electronics and Semiconductor Devices. Conduction mechanisms in semiconductors and metals. Physics, characteristics and models of p-n junction diode. Bipolar junction transistors. Junction and MOS field-effect transistors. Trends in scaled MOSFETs. Short channel MOSFETs. Prereq: EEE 41 or equiv. 4 u.

EE 226 Digital Integrated Circuits. Fundamentals of MOSFETS. Technology and modeling. Scaling and limits of scaling. Design for deep-submicron CMOS – high speed. Design techniques for low power. Arithmetic circuits. Driving interconnect, high-speed signaling. Timing. Memory design. Design for testability. Prereq: CoE 141 or equiv. 6h (3 lec, 3 lab). 4 u.

EE 227 Modern VLSI Design. Digital systems and VLSI. Transistors and layout. Logic functions. Combinational logic networks. Sequential machines. Systems architecture design and HDLs. Subsystem design and IP components. CAD systems and algorithms. Prereq: EEE 21 or equiv. 5 h (2 lec, 3 lab) 3 u.

EE 229 RF Integrated Circuit Design. Introduction to RF and wireless technology. Characteristics of passive devices at RF. High-frequency amplifier design. Analysis of distortion in amplifiers. Low-noise amplifiers and mixers. Oscillators. Frequency synthesizers. Power amplifiers. Phased-locked loops. Modulators and demodulators. Transceiver architectures. Prereq: EE 220. 3 u.

EE 231 Advanced Feedback Control Systems. Transfer functions. Block diagrams. Signal flow graphs. Root locus, Bode, Nyquist and polar plots. Sensitivity. Stability. Compensation techniques. Multivariable systems. Disturbance rejection. Robust control. Adaptive control. state-variable representation and feedback; state-space design; optimal control, computer simulations; design projects. Prereq: EEE 101 or equiv. 3 u.

EE 233 Digital Control Systems Design. Z-transforms and state variable representation of discrete-time systems; models for mixed continuous and discrete-time systems; modeling asynchronous sampling; analysis and design by root locus, frequency response, and state-space techniques; controllability, observability and observer design; linear quadratic optimal control and state estimation; optimization and design issues of mixed continuous and discrete-time systems; inter sample behavior; robust control; sampling rate selection; effects of quantization and finite precision errors ; multi-variable control and optimization; multirate systems; computer simulations; design projects. Prereq: EEE 101 or equiv. 5 h (2 lec, 3 lab) 3 u.

EE 234 Advanced Data Acquisition Systems. Sensors and industrial standards. Storage and display devices. Sensor networks. Prereq: COI. 5 h (2 lec, 3 lab) 3 u.

EE 235 Nonlinear Control Theory. Introduction to nonlinear control with emphasis on differential geometric methods. Linear and nonlinear dynamical systems analysis methods. Describing functions. Lyapunov theory. Popov and the circle criteria. Bifurcation analysis. Controllability, accessibility and observability of nonlinear systems. Differential geometry and nonlinear control from the geometric point of view. Prereq: EE 212. 3 u.

EE 236 Principles of Robotics. Definition of robots and manipulators. Different transformations involved in the study of manipulators. Kinematics and dynamics. Trajectory planning. Prereq: COI. 3 u.

EE 237 Advanced Robotics. Dynamical models for manipulator in Lagrange and Newton-Euler formulations. Controller design based on manipulator dynamics. PID-controllers, eigenvalue assignment and adaptive self-tuning control. Controllers for compliant motion. Prereq: ECE 131. 3 u.

EE 238 Mobile Robotics. Locomotion. Robot kinematics. Perception. Navigation and planning. Map-building. Mobile robot localization. Prereq: COI. 5 h (2 lec, 3 lab) 3 u.

EE 240 Power Electronics I. Application of semiconductor devices and circuits to power systems; power control, conditioning, processing and switching. Prereq: EEE 53 or equiv. 5h (2 lec, 3 lab) 3u.

EE 241 Linear and Switching Power Supplies. Linear converters. Switchmode topologies. DC/DC, AC/DC, DC/AC converters. Applications. Power supply simulation. Prereq: EEE 53 or equiv. 5 h (2 lec, 3 lab) 3 u.

EE 242 Industrial Electronics. Electrical transients. Three phase circuits. Fourier series. Transformers. Rectification. AC/DC thyristor converters. Forced Cmmutation. PWM motor control. AC power control. Applications. Prereq: EEE 101 and EEE 103 or equiv. 3 u.

EE 243 Electromagnetic Compatibility. Transmission lines. Emissions. Modeling. Susceptibility. PCB Design. Shielding. Grounding. Prereq: EEE 23 and EEE 53 or equiv. 3 u.

EE 245 Advanced Theory of Electrical Machines. Reference frames and generalized machine theory. Modeling and analysis of rotating machines during steady state, transient, and dynamic conditions. Prereq: EEE 43 or equiv. 3 u.

EE 246 Dynamics and Control of Electric Motor Drives. Phase- and chopper-controlled DC motor drives. Dynamic modeling of AC machines. Frequency-, phase-, and vector-controlled induction motor drives. Permanent magnet AC, brushless DC, and switched-reluctance motor drives. Simulation of electric drive systems. Prereq: EEE 43 and EEE 51 or equiv. 3 u.

EE 248 Power Amplifiers. Linear amplification. Voltage and current mode amplifiers. Amplifier classes A, B, AB, C. Trans-conductance amplifiers. Composite amplifiers. Resonant and switchmode amplifiers. Prereq: EEE 53 or EE 121 or equiv. 5 h (2 lec, 3 lab) 3 u.

EE 249 Power Electronics II. Principles of steady state converter analysis. Steady state equivalent circuit modeling. Converter circuits. AC circuit modeling. Converter transfer functions. Prereq: EE 240 or equiv. 5 h (2 lec, 3 lab) 3 u.

EE 251 Fault Studies. Symmetrical components. Sequence impedances of transmission lines, synchronous machines and transformers. Phase-domain and sequence-domain analysis of unbalanced and simultaneous faults.

Prereq: EEE 103 or equiv. 5h (2 lec, 3 lab) 3 u.

EE 252 Load Flow Analysis. System modeling and matrix analysis of balanced and unbalanced three-phase power systems. Solution of a system of linear and nonlinear equations. Solution of a system of linear and non-linear equations. Sparsity techniques and optimal ordering. Load flow of balanced and unbalanced three-phase power systems. Prereq: EEE 103 or equiv. 5h (2 lec, 3 lab). 3 u.

EE 254 Surge Protection in Power Systems. Electrical surges including traveling waves due to lightning and switching. Principles of lightning protection. Multi-velocity waves. Electromagnetic transient simulations. Insulation coordination. Application of surge protection devices. Prereq: EEE 25 or equiv. 5h (2 lec, 3 lab) 3 u.

EE 255 Electric Power Transmission and Distribution System Planning. Forecasting models for network planning. Cost models for transmission and distribution facilities. Technical and Economic evaluation. Optimization in transmission and distribution planning. Reliability evaluation of transmission and distribution networks. Prereq: 103 or equiv. 3 u.

EE 256 Power System Protection. Fundamental principles. Selection and application of protective devices and protection algorithms. Protection of transmission lines, transformers, generators, motors, buses, and other equipment. Phase and ground fault protection. Coordination of protective devices. Testing of relays and protection algorithms. Prereq: EEE 103 or equiv. 5 h (2 lec, 3 lab) 3u..

EE 257 Electric Power Transmission and Distribution Network Automation. Transmission and distribution (T&D) system automation requirements. Sensors, actuators, and controllers. T&D automation equipment. Remote Terminal Units (RTUs). Distribution Management Systems. Supervisory Control and Data Acquisition Systems (SCADA) Decision Support Applications. Communications options and communications protocol for T&D utility automation. Design of transmission, substation, and distribution feeder automation/ Case studies and applications. Prereq: EEE 103 or equiv. 5 h (2 lec, 3 lab) 3 u.

EE 258 Electric Power Quality. Modeling for power quality analysis. Harmonics. Time and frequency domain methods of analysis. Grounding. Voltage sags and swells. Electrical transients. Measurement techniques. Mitigation techniques. Power quality standards. Prereq: EEE 103 and EEE 51 and EEE 35 or equiv. 5 h (2 lec, 3 lab) 3 u.

EE 260 Embedded Systems Hardware I. Design of 8, 16, 32-bit microprocessor-based systems using microprocessor integrated circuits and softcores (system-on-a-programmable-chip). Advanced microprocessor features and peripherals. Memory technologies. Interfacing using simple bus protocols. Prereq: EE 227. 5 h (2 lec, 3 lab) 3 u.

EE 261 Embedded Systems Hardware II. Complex bus protocols. Video. Mass storage. Circuit board-level design of embedded systems. High speed circuit board design techniques. Signal integrity issues. Prereq: EE 260. 5 h (2 lec, 3 lab) 3 u.

EE 263 Finite State Machines. Review of clocked sequential circuits. State minimization. State assignment. Pulsed sequential circuits. Fundamental mode sequential circuits. Delays and hazards. State identification. State machine Testing. FSM applications. Prereq: EEE 21 or equiv. 3 u.

EE 264 Computer Architecture. Evolution of computer architecture. Principles of computer system design. Computer system components. Instruction set design. Processor micro-architecture. Pipelining. Cache and virtual memory organizations. I/O structures. Instruction level parallelism. Prereq: EEE 105 or equiv.: 3 u.

EE 265 Advanced Computer Architecture. Vector machines. Out-of-order execution. Dynamic scheduling. Thread level parallelism. VLIW machines. Speculation techniques. Compiler support. Multiprocessor architectures. Multicore architectures. Coherency issues. Interconnection networks. Prereq: EE 264. 3 u.

EE 267 Embedded Software and Operating Systems. Overview of embedded systems. Kernel. Bootloader. Toolchain. Root Filesystems. Memory Technology Devices. I/O Subsystem. Device Driver. Introduction to Applications Programming. Prereq: EE 260 and EEE 13 or equiv. 5 h (2 lec, 3 lab) 3 u.

EE 268 Embedded Software Applications Development. Software engineering methodologies applied to embedded systems program development. Quality Assurance techniques. Software maintenance issues. Functional and non-functional software properties. Prereq: COI. 3 u.

EE 269 Digital Systems Testing. Test economics and motivation. Fault models and simulation. Test pattern generation. Measures for testability. Design for testability. Memory testing. Prereq: EEE 21 & EEE 41 or equiv. 3u.

EE 270 Digital Communications I. Methods of digital modulation and demodulation. Signal space methods in digital communications. Communication over AWGN and band-limited channels, including channel capacity. Carrier and symbol synchronization. Source coding and lossless compression. Channel coding, including block codes, convolutional codes and Viterbi decoding. Current topics of interest. Prereq: EEE 107 or equiv. 5 h (2 lec, 3 lab) 3 u.

EE 271 Microwave Theory and Techniques. Analysis and synthesis of transmission lines and waveguides. Microwave resonators. Microwave network analysis. Analysis and design of passive and active microwave devices. Noise in microwave circuits. Circuit models of active devices. Magnetic materials and their applications. Microwave test and measurement principles. Prereq: EE 217. 3 u.

EE 272 Radiowave Propagation and Radio Link Design. Transmission loss. Free-space propagation. Propagation at low and high frequencies. Microwave propagation. Propagation over plane and spherical surfaces. Propagation in the ionosphere, troposphere and near-earth. Antennas. Design considerations for noise, diffraction, refraction, absorption, multipath interference, and scattering in wireless communications, including mobile communications and satellite links. Prereq: EEE 23 or equiv. 3 u.

EE 273 Antenna Engineering. Radiation from simple and extended sources and arrays. Antenna theorems. Scattering concepts. Analysis and design of wire, aperture, traveling wave, reflector, microstrip and miniaturized antennas. Modern antenna systems. Receiving antenna considerations. Prereq: EEE 23 or equivalent. 3 u.

EE 274 Digital Signal Processing I. Sampling theorem. Discrete time signals and LTI systems. Discrete convolution. Z- transform. FIR and IIR digital filters. Discrete Fourier transform. Fast Fourier Transform. State-space analysis. Prereq: EEE 35 or equiv. 5 h (2 lec, 3 lab) 3 u.

EE 275 Networking Technologies I. Layered network architecture. Link layer protocols. Packet switching. LAN and WAN routing. Transport protocols. Applications. Prereq: EEE 13 and EEE 107 or equiv. 3 u.

EE 276 Statistical Communication Theory. Principles and applications of detection and estimation theories in communication systems. Bayes and the Neyman-Pearson criteria. Cramer-Rao bound. Minimum variance unbiased estimation, maximum likelihood, EM, MAP, linear MMSE estimation. Hypothesis testing. Applications in modern digital communications, radar and sonar signal processing. Prereq: EE 214 and EE 274. 3 u.

EE 277 Coding and Information Theory. Error detecting and error correcting codes. Block codes and convolutional codes. Analysis and design of error-control channel codes. Modeling of information sources, including zero-memory and Markov models. Construction of compact source codes. Entropy, mutual information and channel capacity. Shannon's noiseless and noisy coding theorems. Examples of modern source and error control codes. Prereq: EEE 25 or equiv. 3 u.

EE 279 Networking Technologies II. Distributed systems and applications. Network architectures and technologies. Network protocols. Routing and congestion control. Modeling, simulation, and performance analysis. Emerging applications. Prereq: COI. 5 h (2 lec, 3 lab) 3 u.

EE 280 Wireless Communication Systems. Radio propagation and antennas. Large-scale and small-scale propagation models. Performance of wireless communication systems in fading channels. Coding, equalization and diversity. TDMA, FDMA, CDMA, SDMA and random access protocols. Examples of modern and practical systems, including cellular systems, wireless local area networks, wireless personal area networks and broadband wireless access systems. Co-req: EE 270 or equiv. 3 u.

EE 281 Optical Communications Systems. Optical fiber fundamentals. Single mode and multimode fibers. Optical fiber bandwidth. Optical sources, light-emitting diodes and lasers. Optical detectors, modulators, switches and directional couplers. Optical communications systems design. Wavelength division multiplexing and other topics of interest. Prereq: EEE 41 or equiv. 3 u.

EE 282 Adaptive Filtering and Array Processing. Theory and applications of adaptive filtering in systems and signal processing. Iterative methods of optimization and their convergence properties. Transversal filters. LMS and gradient-search algorithms. Kalman filtering and least-squares algorithms. Array fundamentals. Optimum array processing. Adaptive beam forming. Space-time processing and space-time coding. MIMO. Current topics of interest. Prereq: EE 274 or equiv. 5h (2 lec, 3 lab). 3 u.

EE 283 Digital Image Processing. Digital image fundamentals. Introduction to two-dimensional digital signal Processing. Image enhancements in spatial and frequency domain. Image transforms. Image restoration. Color image

processing. Wavelets and image compression. Morphological image processing. Image segmentation, representation, and description. Introduction to object recognition and computer vision. Advanced topics and applications of image processing analysis. Prereq: CoE 121 or EE 274 or COI. 3 u.

EE 284 Speech Signal Processing. Feature Extraction. Speech Recognition. Hidden Markov Modeling. Speech Production Models. Pitch Detection. Prosody. Speech Synthesis. Speech Coding. Prereq: EEE 35 or equiv. 5 h (2 lec, 3 lab) 3 u.

EE 285 Digital Video Signal Processing. Digital video fundamentals. Video formation, perception, and representation. Fourier analysis of video signals. Frequency response of the human visual system. Video sampling and rate conversion. Video modeling. 2-D and 3-D motion estimation. Video coding: waveform-based coding and content-dependent coding. Scalable video coding. Stereo and multi-view sequence processing. Video components standards. Error control in video communications. Advanced topics and applications of video analysis, processing, streaming, compression, error control, and transmission. Prereq: CoE 121 or EE 274 or COI. 5 h (2 lec, 3 lab) 3 u.

EE 286 Digital Audio Signal Processing. Digital audio signal analysis and manipulation. Speech and musical instrument synthesis. Digital audio recording and reproduction. EEE 35 and EEE 11, or COI. 5 h (2 lec, 3 lab) 3 u.

EE 290 Directed Studies. Independent study or investigation of directed, current research areas in electrical and electronics engineering. Collaborative peer discussions of study results and findings. Prereq: COI. 3 u.

EE 296 Seminar. 1 u. per sem; max. of 3 u.

EE 298 Special Problems. Course may be repeated for credit, up to a maximum of 12 units, provided that topics are different; topics to be indicated for record purposes. 3 u

EE 299 Electrical Engineering Project. Prereq: COI. 3 u.

EE 300 Thesis. 3 u. to 6 u.

EE 317 Mathematical Methods for Electromagnetics I. Analytical and numerical methods of solving practical problems in electromagnetics, including fundamental theorems, plane wave functions, cylindrical wave functions, variational techniques, geometric theory of diffraction, method of moments, finite difference time domain method and Galerkin's method. Computer programming exercises. Prereq: EE 217 and ES 204. 3 u.

EE 318 Mathematical Methods for Electromagnetics II. Variational techniques, geometric theory of diffraction, Galerkin's method, finite difference time domain method, method of moments; recent topics of interest; computer programming exercises. Prereq: EE 317. 3 u.

EE 320 Analysis and Design of High Performance Digital Integrated Circuits. Parasitic models and second-order effects of field-effect and bipolar transistors, and interconnects; clock skew and other timing issues; design of high-performance combinational and sequential logic circuits; arithmetic and memory structures and devices; charge-coupled device circuits; signaling, synchronization, noise and clock and power distribution issues; extraction of circuit parameters from process parameters; optimization at the device and circuit levels; circuit-systems issues; design projects. Prereq: EE 226 Co-req: EE 325. 4 u.

EE 322 Analysis and Design of Monolithic Information Processing and Communication Circuits. Small and large-signal models of field-effect and bipolar transistors; amplifiers, switched capacitor networks, sample and hold, multiplexers, analog to digital and digital to analog converters, active filters, comparators, analog multipliers, relaxation oscillators, phase detectors, phase-locked loops, voltage-controlled oscillators, mixers, sampled-data filters, digital decimation and interpolation filters; charge-coupled device circuits; architectural and circuit level performance evaluation; design projects. Prereq: EE 220. Co-req: EE 325. 4 u.

EE 325 Semiconductor Devices II. Compound semiconductors and hetero-junctions; dielectric and optical properties; optical processes; physics and models of high-frequency, high-speed and optoelectronic devices including HFET, HBT, MESFET, quasi-ballistic transistors and other sub-micron transistor concepts, and charge-coupled devices. Prereq: EE 225. 3 u.

EE 326 Optoelectronic Devices. Optical properties and processes; optical detectors, light-emitting diodes, solar cells, modulators, switches, directional couplers, lasers and others of interest. Prereq: EE 325. 3 u.

EE 327 Advanced VLSI Design. Advanced VLSI technologies; system architecture; system behavior modeling in

VHDL or C; CAD tools for standard cell, custom design or hybrid techniques; integration of heterogeneous CAD tools; automated and manual synthesis; advanced circuit design and testing methods; synthesis of the different levels of design hierarchy; design projects. Prereq: EE 227. 3 u.

EE 330 Optimal Control. Theoretical methods in optimal control theory. Topics include the review of the optimality conditions: Lagrange and Kuhn-Tucker. The calculus of variations and the Pontryagin minimum principle with applications to minimum energy problems. Geometric methods will be applied to the solution of minimum time problems. Computational methods, singular problems, observer theory, and sufficient conditions for existence of solutions are also discussed. Prereq: EE 212. 3 u.

EE 353 Power System Reliability. Basic reliability concepts. Methods for reliability modeling and evaluation. Reliability measures. Reliability of generation, transmission, distribution, composite, and interconnected systems. Prereq: EEE 25 or equiv. 3 u.

EE 355 Power System Planning. Financial modeling. Load forecasting. Production simulation. Generation planning. Network planning. System planning in a competitive electricity industry. Prereq: EEE 103 or equiv. 3 u.

EE 357 Power System Dynamics and Stability. Modeling, analysis, and simulation of power systems subjected to small and large disturbances. Steady state, transient, and dynamic stability assessment and enhancement. Multi machine studies. Recent developments. Prereq: EEE 103 or equiv. 3 u.

EE 358 Economic Operation of Power Systems. Economics of energy generation and operation. Optimization methods. Mixed-generation dispatch. Unit commitment. Optimal load flow. Competitive markets for electricity generation. Recent developments. Prereq: EEE 103 or equiv. 3 u.

EE 359 Power Systems Operation and Control. Modern power system operational and control problems and solution techniques, including load frequency control, automatic generation control, system voltage control, security assessment, state estimation, and contingency analysis. System control centers. Interconnected systems. Prereq: EEE 103 or equiv.: 3 u.

EE 370 Digital Communications II. Communication over band-limited and fading channels. Multipath propagation. Channel equalization and adaptive techniques. Fractionally-spaced equalizers. Decision feedback equalization. Spread spectrum systems, multiuser access and detection. Current topics of interest. Computer exercises. Prereq: EE 270. 3 u.

EE 371 Microwave Integrated Circuits I. Computer-aided analysis and design of distributed circuit structures and their applications in passive and active microwave circuits including dividers, directional couplers, circulators, filters, transistor amplifiers, attenuators; experimental characterization; design projects. Prereq: EE 271 and EE 325. 3 u.

EE 372 Microwave Integrated Circuits II. Computer-aided analysis and design of distributed circuit structures and their applications in passive and active microwave circuits including transistor amplifiers, mixers, modulators, demodulators, oscillators, frequency converters, phase shifters, harmonic generators; noise models and low-noise design; monolithic MIC; fabrication processes of monolithic circuits; experimental characterization; design projects. Prereq: EE 371. 3 u.

EE 374 Digital Signal Processing II. Multirate processing. Optimal methods in filter design. Superior filter structures. Advanced finite word length effects. Non-parametric and parametric spectrum estimation. Adaptive filters, Wiener filters and algorithms. Time-frequency analysis and wavelets. Linear prediction. Current topics of interest. Computer exercises. Prereq: EE 214 or equiv. and EE274. 5 h (2 lec, 3 lab) 3 u.

EE 398 Special Problems. 3 u.

EE 400 Dissertation. 12u

GENERAL EDUCATION (GE) COURSES

OFFERING UNIT	COURSE CODE & NUMBER	COURSE TITLE	COURSE DESCRIPTION	CREDIT UNITS
ARTS AND HUMANITIES (AH)				
UPEPP	Araling Kapampangan 10	Mekeni Abe: Pangkalahatang Sarbey ng Kulturang Kapampangan	Isang pangkalahatang pagtingin sa kultura ng rehiyon ng Pampanga kaugnay ang kasaysayan, panitikan, sining at sosyolohiya na nakapaloob dito.	3
CAL, UPEPP	Eng 1 ¹	Basic College English	Basic grammar, usage & composition skills in English.	3
CAL	Phil Stud 12 ²	Suroy---suroy sa Wika, Panitikan at Kultura sa mga isla ng Luzon, Visayas at Mindanao.	Mga panimulang pag---aaral sa mga wika, panitikan at kultura sa Pilipinas at ang kaugnayan at ambag nito sa kaliningang pambansa sa kapuluan.	3
CAL	Art Stud 1	Art & Society	Critical exploration of the arts in dynamic interaction with society.	3
CAL	Art Stud 2	Art Around Us: Exploring Everyday Life		3
CAL	Comm 3	Practical Speech Fundamentals	Speaking & listening skills & their applications in various communication situations.	3
CAL	CW 10	Creative Writing for Beginners	A workshop exploring the potentials of creative writing as expression, as discipline & as a way of thinking about the society in which we live.	3
CAL, UPEPP	Eng 1 ¹	Basic College English	Basic grammar, usage & composition skills in English	3
CAL	Eng 10 ^{1a}	College English	The writing & critical reading of forms of academic discourse essential to university work.	3
CAL	Eng 11	Literature & Society	The study of various literary genres as a dynamic interaction between the individual & social & cultural forces.	3
CAL	Eng 12	World Literatures	The study of representative/landmark texts from the literatures of the world.	3
CAL	Eng 30 ⁴	English for the Professions	Principles & uses of writing in English in the various disciplines/professions.	3
CAL	EL 50 ⁴	European Cultures & Civilizations	Europe's contributions to world cultures civilizations, & languages.	3
CAL	Fil 25	Mga Ideya at Estilo	Mapanuring pag---aaral ng mga ideya at estilosa mga piling sanaysay sa agham at sining mula sa Pilipinas at iba pang bansa.	3
CAL	Fil 40 ^{2,4}	Wika, Kultura at Lipunan	Ang relasyon ng Filipino sa kultura at lipunang Pilipino.	3
CAL	Humad 1 ²	Panitikan, Tao at Lipunang Filipino	Ang pag-aaral ng iba't-ibang anyong pampanitikan bilang malikhaing pahayag ng mga indibidwal na karanasan at mga pagpapahalaga at mithiin ng lipunang Filipino.	3
CAL	Kom 1	Kasanayan sa Komunikasyon	Paglinang sa kakayahang magpahayag sa wikang Filipino na nakatuon sa mabisa at mapanuring pagbasa, pakikinig at pagsulat.	3
CAL	Kom 2	Kasanayan sa Komunikasyon	Paglinang sa kasanayan sa paggamit ng wikang Filipino sa higit na mapanuring pag-iisip at masinop na pananaliksik.	3
CAL	MPs 10 ²	Ang Hiwaga at Hikayat ng Panulat sa Filipino	Malikhaing pagbasa at masining na pagsulat ng mga natatanging anyong pampanitikan, kasama ang mga makabagong anyong teknolohikal.	3
CAL	Pan Pil 12 ²	Text Mo/Text Ko: Panimulang Pag-aaral ng Panitikang Pilipino	Mga Panimulang pag-aaral sa panitikan ng Pilipinas, mula sa tradisyunal na anyo hanggang sa mga teksto mula sa kulturang popular.	3
CAL	Pan Pil 17 ²	Panitikan at Kulturang Popular	Ang relasyon ng panitikan at popular na kultura sa kasalukuyan.	3

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ARTS AND HUMANITIES (AH)				
CAL	Pan Pil 19 ^{2,4}	Sexwalidad, Kasarian at Panitikan	Pag-aaral ng interaksyon ng panitikan at mga usapin sa sexwalidad at kasarian	3
CAL	Pan Pil 40 ^{2,4}	Panitikan at Lipunang Pilipino mula 1946 Hanggang sa Kasalukuyan	Ang mga nangingibabaw na tema, anyo at kalakaran ng Panitikan ng Pilipinas pagkaraan ng Ikalawang Digmaang Pandaigdig.	3
CAL	Pan Pil 50 ^{2,4}	Panitikang Makabayan	Ang mga namumukod na katangian ng panitikang makabayan at ang mga impluwensiya dito.	3
CAL	Theatre 10	Onstage, Offstage	A window to the world of the theatre, its humanizing role in society & its relationship to the other arts.	3
CAL	Theatre 11 ²	Dula at Palabas	An introductory survey to Philippine Theatre from rituals to contemporary forms.	3
CAL	Theatre 12	Acting Workshop	An introduction to the art & skill of acting for the theatre.	3
ARCH	L Arch 1 ^{2,5}	Designing Eden: Introduction to Philippine Landscape Architecture	Walking-through Philippine landscape architecture through sciences and arts.	3
CFA	FA 28 ²	Arts in the Philippines	Arts & art making the Filipino way.	3
CFA	FA 30	Art Pleasures	The fine art of enjoying art.	3
CMC	Film 10	Sineng Sine	Film as art & social practice.	3
CMC	Film 12 ²	Sine Pinoy	Philippine cinema as art form & cultural product.	3
CMC	J 18	News in the New Century	Reading & understanding the news towards developing a critical public voice.	3
CMC	BC 10	Radio & Television: On-Air/Off-Air	Understanding the dynamics of broadcasting	3
MUSIC	MuD 1	Reading Dance	An approach to understanding dance as art & as cultural phenomenon.	3
MUSIC	MuL 9 ^{5a}	Musics of the Philippines	An overview of indigenous musical traditions & musical idioms associated with cultures of various peoples of the Philippines.	3
MUSIC	MuL 13	World Music Cultures	A study of music from representative regions of the world from the perspectives of music as a sonic object, as a social act & as thought & cognition.	3
CIS	SEA 30 ²	Asian Emporiums: Networks of Culture & Trade in Southeast Asia	An introduction to the world of monsoon Asia as formed by interaction among its peoples throughout the centuries.	3
MATH, SCIENCE, AND TECHNOLOGY (MST)				
CHE	FN 1	Food Trip	Food and nutrition in daily living.	3
CS	BIO 1	Contemporary Topics in Biology	Recent developments in biology pertinent to concerns about the nature of life, health & related social issues.	3
CS	Chem 1 ⁶	Chemistry: Science that Matters	Basic chemistry concepts relevant to everyday life.	3
CS	Env Sci 1	Environment & Society	Introduction to principles & concepts in the study of the natural environment within a societal framework.	3
CS	Geol 1	Our Dynamic Earth	The study of how the earth works, its place in the universe; & relationship between people & the physical environment.	3

OFFERING UNIT	COURSE CODE & NUMBER	COURSE TITLE	COURSE DESCRIPTION	CREDIT UNITS
MATH, SCIENCE, AND TECHNOLOGY (MST)				
CS	Math 1 ⁷	General Mathematics	The development of mathematical literacy & appreciation through a synoptic view of the different branches of mathematics with historical notes & applications.	3
CS	Math 2 ^{7a}	Practical Mathematics	Basic mathematics skills & applications in everyday life.	3
CS	MBB 1	Biotechnology & You	Historical events, processes, products, issues & concerns in modern biotechnology.	3
CS	MS 1	Oceans & Us	An appreciation course on the functional balance between the health of the oceans & the survival & improvement of our way of life.	3
CS	Nat Sci 1 ⁶	Foundations of Natural Science 1	Fundamental concepts, principles & theories of physics & chemistry.	3
CS	Nat Sci 2	Foundations of Natural Science 2	Fundamental concepts, principles, & theories of earth & life sciences.	3
CS	Physics 10 ⁶	Physics & Astronomy for Pedestrians	A "walk-through" course for people who want to enjoy physics & astronomy.	3
CS	STS	Science, Technology & Society	The analysis from historical & futuristic perspectives of the nature & role of science & technology in society & of the socio-cultural & politico-economic factors affecting their development with emphasis on Philippine setting.	3
CS	MBB 1	Biotechnology & You	Historical events, processes, products, issues & concerns in modern biotechnology.	3
COE	EEE 10	Everyday EEE: Kuryente, Radyo atbp.	Electrical & electronics engineering in everyday life.	3
COE	ES 10	Forces at Work	Principles of engineering mechanics & their relevance to everyday life.	3
COE	GE 1	Earth Trek	A guided exploration into the tools & techniques of earth observation & measurement.	3
COE	CE 10 ^{5b}	DMAPS: Disaster Mitigation, Adaptation and Preparedness	Introduction to principles and practices of natural disaster risk management by mitigation, adaptation, and preparedness strategies through civil engineering and related disciplines aiming for resilience.	3
ARCH	L Arch 1 ^{2,5}	Designing Eden: Introduction to Philippine Landscape Architecture	Walking-through Philippine landscape architecture through sciences and arts.	3
SOCIAL SCIENCES AND PHILOSOPHY (SSP)				
CSSP	Anthro 10	Bodies, Senses & Humanity	Interaction of biology & culture in the shaping of humanity.	3
CSSP	Geog 1	Places & Landscapes in a Changing World	Overview of the diversity of interconnections of peoples & places in a globalizing world as mediated by cultures, politics & historical developments.	3
CSSP	Kas 1 ²	Kasaysayan ng Pilipinas	Ang pagsulong na pulitikal, pang-ekonomiya, panlipunan at pagkalinangan ng Pilipinas.	3
CSSP	Kas 2	Ang Asya at ang Daigdig	Ang pamanang pangkalinangan ng Asya sa pagkaka-ugnay at ang kaugnayan nito sa kabihasang pandaigdig.	3

OFFERING UNIT	COURSE CODE & NUMBER	COURSE TITLE	COURSE DESCRIPTION	CREDIT UNITS
SOCIAL SCIENCES AND PHILOSOPHY (SSP)				
CSSP	Lingg 1	Ikaw at Wika Mo	Mga pangunahing konsepto tungo sa pag-unawa, paggamit at pagpapahalaga sa wika bilang produkto ng talino ng tao sa kanyang pang-araw-araw na pakikipag-ugnayan, at higit sa lahat, sa konteksto ng sitwasyong pangwika sa Pilipinas.	3
CSSP	Philo 1	Philosophical Analysis	Application of basic concepts, skills & principles drawn from the Philosophy of Language, Symbolic Logic, Epistemology, Philosophy of Science & Ethics.	3
CSSP	Philo 10	Approaches to Philosophy	Overview of major philosophical traditions.	3
CSSP	Philo 11	Logic	Techniques of formal deduction within the scope of sentential & predicate logic.	3
CSSP	Soc Sci 1	Foundations of Behavioral Sciences	A survey of basic concepts, principles, theories & methods of the behavioral sciences (Sociology, Psychology, Anthropology, Political Science, Economics, including Linguistics Demography & Geography) & the dynamics of social change.	3
CSSP	Soc Sci 2	Social, Economic & Political Thought	A survey of social, economic & political thought from the classical to contemporary times.	3
CSSP	Soc Sci 3	Exploring Gender & Sexuality	A cross-cultural survey of gender & sexuality, applying perspectives from the different social sciences.	3
CSSP	Socio 10 ²	Being Filipino: A Sociological Exploration	A sociological examination of the persistent issues of nationhood, selfhood & citizenship in Philippine society.	3
ASP	Archaeo 2	Archaeological Heritage: The Past is not a Foreign Land	A survey of archaeological research & its role in the development of knowledge about the human collective past, the past of specific cultures, especially those of Southeast Asia, & the nature & role of heritage in the contemporary world.	3
ASP	Arkiyoloji 1 ²	Ang Pilipinas: Arkiyoloji at Kasaysayan	Tatalakayin ang kasaysayan ng Pilipinas, nakasentro sa kaalaman mula sa arkiyoloji. Ipaalam din ang malawak na ugnayan ng sinaunang kasaysayan ng rehiyon sa kasaysayan ng Pilipinas.	3
ECON	Econ 11	Markets & the State	Essential economic concepts & their use in analyzing real-world issues.	3
ECON	Econ 31 ^{3a}	A Journey Through Time: Economic Ideas & Civilization	A survey of the influence of economic ideas on historical events of the last century & a half.	3
ARCH	L Arch 1 ^{2,5}	Designing Eden: Introduction to Philippine Landscape Architecture	Walking-through Philippine landscape architecture through sciences and arts.	3
CIS	SEA 30 ^{5a}	Asian Emporiums: Networks of Culture & Trade in Southeast Asia	An introduction to the world of monsoon Asia as formed by interaction among its peoples throughout the centuries.	3
COE	CE 10 ^{5b}	DMAPS: Disaster Mitigation, Adaptation and Preparedness	Introduction to principles and practices of natural disaster risk management by mitigation, adaptation, and preparedness strategies through civil engineering and related disciplines aiming for resilience.	3

NOTES:

1. Comm 1 & English 1 are equivalent courses and therefore only one (1) course will be credited towards the GE requirement.
- 1a. Comm 1 & English 10 are equivalent courses and therefore only one (1) course will be credited towards the GE requirement
2. May be taken to satisfy Philippine Studies requirement.
3. Preferably Junior Standing
- 3a. Preferably Junior or Senior Standing
4. Preferably Sophomore Standing
5. Can be taken to fulfill GE requirement either AH, MST, or SSP; Can only be credited once
- 5a. Can be taken to fulfill GE requirement either AH or SSP; Can only be credited once
- 5b. Can be taken to fulfill GE requirement either MST or SSP; Can only be credited once
6. This course cannot be taken by students in the College of Engineering except those under the BS Computer Science Program.
7. Math 1 cannot be taken by BS Math students
- 7a. Math 2 cannot be taken by students of degree programs which require at least Math 11

RETENTION RULES

Students who wish to study and pursue careers in electrical and electronics engineering and any of its allied fields need to acquire a strong background in the fundamentals of mathematics, physics, and other engineering sciences, in addition to courses in their chosen field. To ensure that student aptitudes and interests match the rigors and demands of the program, and that graduates consistently meet the high quality standards expected of products of our programs, the Institute enforces *academic retention rules* that EEE undergraduate students must satisfy, in addition to existing College and University academic rules and regulations, in order to remain in good academic standing.

A student will be permanently dismissed from any EEE undergraduate program if he or she:

- Incurs a grade other than a passing grade twice in any of these mathematics courses: (Math 17, 53, 54, 55);
- Accumulates three or more grades other than passing grades in any combination of these mathematics courses (Math 17, 53, 54, 55);
- Incurs a grade other than a passing grade twice in any of these basic EEE courses (EEE 23, 31, 33, 35, 41);
- Accumulates three or more grades other than passing grades in any combination of these basic EEE courses (EEE 23, 31, 33, 35, 41)

For purposes of this retention rule, a "grade other than a passing grade" includes the following: a 5.0, an unremoved 4.0, an unremoved INC, or a DRP recorded at the end of the semester or semesters under evaluation.