APPENDIX 2 – Curriculum of the Joint Program

FIRST YEAR (Taken at IUS)					
Fall Semester			**Spring Semester**		
Code	**Title**	**Credits (ECTS)**	**Code**	**Title**	**Credits (ECTS)**
ELIT113	Technical English	3	ENS203	Electrical Circuits I	6
ENS205	Materials Science	3	ENS213	Programming for Engineers	6
MATH101	Calculus I	6	MATH102	Calculus II	6
NS102	Physics	6	NS105	Physics II	6
ENS221	Introduction to Engineering	3	MATH201	Linear Algebra	6
NS104	General Chemistry	6	ELIT213	Introduction to Academic Writing	3
		27			33
SECOND YEAR (Taken at IUS)					
Fall Semester			**Spring Semester**		
Code	**Title**	**Credits (ECTS)**	**Code**	**Title**	**Credits (ECTS)**
EE201	Analog Electronics I	6	CS303	Digital Design	6
EE202	Electrical Circuits II	6	EE301	Analog Electronics II	6
EE221	Object Oriented Programming	6	ENS201	Electromagnetism I	6
MATH202	Differential Equations	6	ENS211	Signals and Systems	6
MATH203	Introduction to Probability and Statistics	6	MATH205	Numerical Analysis	6
		30			30
THIRD YEAR (Taken at ITU)					
Fall Semester			**Spring Semester**		
Code	**Title**	**Credits (ECTS)**	**Code**	**Title**	**Credits (ECTS)**
EHB 311E	Intr.to Electronics Laboratory	2.5	EHB 362E	Microwave Engineering	4.5
EHB 313E	Electromagnetic Waves	5.5	KON 317E	Control Systems	5
EHB 315E	Digital Signal Processing	5	EHB 322E	Digital Electronic Circuits	5
EHB 351E	Analog Communications	5.5	EHB 352E	Digital Communications	5
EHB 335E	Analog Electronic Circuits	5	DAN 301	Kariyer Danışmanlığı	1
	5th Sem.Elect.Course (TM)	4		6th Sem.Elect.Course I (MT)	4
	5th Sem. Elective Course(TB)	4/5/6		6th Sem.Elect.Course II (MT)	5/5.5/6
				6th Sem.Elect.Course (ITB)	4
	31.5 – 33.5			33.5 – 34.5	
FOURTH YEAR (Taken at ITU)					
Fall Semester			**Spring Semester**		
Code	**Title**	**Credits (ECTS)**	**Code**	**Title**	**Credits (ECTS)**
ATA 101	Atatürk İlk & İnkılap Trh I	2	ATA 102	Atatürk İlk & İnkılap Trh II	2
EHB 4901E	Elect.&Comm. Eng. Design I	-	EHB 4902E	Elect.&Comm. Eng. Design II	-
TUR 101	Türk Dili I	2	TUR 102	Türk Dili II	2
	7th Sem.Elect.Course (ITB)	4		8th Sem.Elect.Course (ITB)	4
	7th Sem.Elect.Course I (MT)	5/6		8th Sem.Elect.Course I (MT)	5/5.5
	7th Sem.Elect.Course II (MT)	5/6		8th Sem.Elect.Course II (MT)	5/5.5
	7th Sem.Elect.Course III (MT)	5/6		8th Sem.Elect.Course III (MT)	5/5.5
	7th Sem.Elect.Course IV (MT)	5/6		8th Semester Elct. Course (SNT)	5/5.5
		28 - 32			28 – 30

Minimum 30 days of internship is compulsory at ITU.

Course Catalog Descriptions for Required Courses taken at IUS:

CS303 Digital Design: A standard introductory course on building blocks of digital electronics. Students will learn the axioms of Boolean algebra, number systems and representation, functionality of logic gates, encoders, decoders, multiplexers, demultiplexers, adders, subtractors, flip-flops etc. The course includes analysis and design of simple finite state machines. Physical implementation of different circuit families is briefly studied as well as architecture of digital memory. Students will also learn to implement digital circuits in programmable logic devices using VHDL.

EE201 Analog Electronics I: Conduction. Semiconductors, carriers, p-type and -type doping, drift and diffusion mechanisms, physical structure and behavior of the pn junction. Ideal diode, practical diode, electrical behavior and current-voltage curve. Diode model. DC analysis methods for diode circuits (constant voltage drop model, fixed point iteration with the exponential model). Small signal approximation, diode small signal equivalent and AC analysis of the diode circuits, DC power supply design (rectifiers, analysis of the topology with filter capacitor). Zener diode and regulation. Body resistance and parasitic capacitors. Other diode types. Physical structure and behavior of the bipolar-junction transistor (BJT), the Early phenomenon, BJT operation regions, electrical model (Ebers-Moll) and characteristics. DC biasing and thermal stability of BJT circuits. Physical structure and behavior of MOSFET, operation regions, characteristics, important secondary effects (channel length modulation, body effect). DC biasing and thermal stability of MOSFET circuits. Switching applications of BJT and MOSFET, the conceptual usage in digital circuits.

EE202 Electrical Circuits II: State and output equations of higher-order dynamic circuits. State transition matrix and properties. Zerostate, zero-input and total responses. Sinusoidal steady state. Finding the state and output equations of dynamic networks and systems in jw- domain. Phasors. Power. Three-phase systems. Finding the state and output equations of dynamic networks and systems in s-domain. Impedance and admittance. Stability and Routh Criteria. Network functions and parameters. Block and signal flow diagrams. Bode diagrams.

EE221 Object Oriented Programming: Data types, Control Statements, Loops, Arrays, Functions, Pointers, Dynamic memory, Abstraction & Encapsulation, Class, Object, Constructor & Destructor, Inheritance & Polymorphism, Class hierarchy, Superclass, Subclass, Abstract classes, Interface, Virtual method, Operator overloading.

EE301 Analog Electronics II: Amplification and the gain concept, desiBell concept, voltage amplifier / current amplifier / transconductance circuit / transresistance circuit models, conceptual function of the transistor in amplification. DC analysis of transistorized (BJT, MOSFET) circuits. Small signal equivalents and terminal resistances of BJT and MOSFET. AC analysis of BJT and MOSFET amplifiers: Gain and input/output resistance of basic amplifier stages, analysis of cascade (direct/capacitivelycoupled) amplifiers. Cascode structure, Darlington structure. Differential amplifier, differential and common-mode gains, common mode rejection ratio. Current sources, active-loaded circuits. Operational amplifier, ideal and practical behavior, internal structure of a sample OpAmp. Linear and non-linear applications of the OpAmp, effect of nonidealities on the behavior. Power amplifiers.

EENS221 Introduction to Engineering: This course is an orientation course for the Engineering depatment first year students. It aims to make the adaptation for the students easier, and to inform them on the general subject matter of electronics as well as telecommunications engineering, engineering ethics and quality. Various faculty members give presentations to the students. Examples of applications are provided, plus engineering code of ethics, ethical responsibilities, quality issue in design and applications are discussed.

ELIT113 Technical English: This course is designed to improve students' reading skills by reading and analyzing technical and academic texts and academic and technical writing skills by using the elicited information. Students not only learn about the requirements of Academic and Technical English but also improve their other linguistic and critical thinking skills. Students are expected to extensively describe an object and mechanism by using proper technical language, to classify the information they researched and write an analytic composition on their classification, to cite all the information they utilized throughout the process.

ELIT213 Introduction to Academic Writing: The course designed to teach the organizational and critical

thinking skills necessary for logical written expression. The course focuses on writing a research paper of at least 3000 words based on sound scholarly sources on a topic of interest related to a student's field by conforming to the APA standards of writing without committing plagiarism. In this course the whole research process is taught step by step through skills including research, source selection, choice of topic, construction and defense of a thesis statement, citing sources, outlining, organizing a "References" page and note taking. Critical elements of the course are instruction in paraphrasing and summarizing techniques, use of quotations and the incorporation of these research findings in the paper together with the inclusion of personal comments, avoidance of plagiarism and conforming to ethical rules.

ENS201 Electromagnetism I: Vector analysis, vectorial differential operators, static electric field, electric potential, electrostatic field analysis in conductors and dielectric media, electrostatic energy, electrostatic boundary conditions, magnetostatic field, vector potential, magnetic circuits, magnetic energy, magnetostatik boundary conditions, quasi-static fields, time varying fields and Maxwell equations

ENS203 Electrical Circuits I: Electric circuits, Models and Circuits elements. Kirchhoff's laws: Kirchhoff's voltage law and Kirchhoff's current law. Graph theory, element graph: Branch currents, branch voltages, Graph matrices. Tellegen Theorem and Conservation of energy. Two terminal elements: resistor, capacitor and inductor. Independent sources, dependent sources. Three terminal elements: Gyrator, transistor, transformer. Nonlinear elements Linearized models. Node voltage method and mesh current method for resistive circuits. Thevenin and Norton equivalent circuits. RLC circuits: First order and second order circuits. State equation and state variables for linear time invariant circuits. Solution of second order state equations.

ENS205 Materials Science: Introduction to materials science and classification of atomic structures of the materials. Crystal structures and imperfections. Mechanical and physical properties of the engineering materials. Solid-state diffusion. Phase diagrams and solidification. Ferrous / non-ferrous alloys and heat treatment. Electrical, optical, thermal and magnetic properties associated with electron band structures of the materials. Metallic corrosion and prevention from corrosion. Principle geomaterials, their properties and application areas. Deterioration of geomaterials.

ENS211 Signals and Systems: Classification of signals, basic signals, classification and properties of systems, time domain characterization of Linear Time Invariant (LTI) systems, Continuous-Time and Discrete-Time Fourier Series, Continuous-Time and Discrete-Time Fourier Transforms, frequency domain characterization of Linear Time Invariant (LTI) systems, Sampling, z-transform and its applications.

ENS213 Programming for Engineers: Programming for Engineers, Introduction to Scientific and Engineering Computing, Introduction to Program Computing Environment, Variables, Operations and Simple Plot, Algorithms and Logic Operators, Flow Control, Errors and Source of Errors, Functions, Linear Algebra Applications, Solving Equations Applications, Polynomials Examples, Curve Fitting Applications, Interpolation Applications, Numerical Integration Applications, Symbolic Mathematics, ODE Solutions with built-in functions

MATH101 Calculus I: Functions of a Single Variable, Limits and Continuity, Derivatives, Applications of Derivatives, Sketching Graphs of Functions, Asymptotes, Integration, Fundamental Theorem of Calculus, Applications of Integrals, Polar Coordinates, Transcendental Functions, Techniques of Integration, Indeterminate Forms, L'Hopital's Rule.

MATH102 Calculus II: Improper Integrals, Infinite sequences and series, Vectors in Space, Vector-Valued Functions, Multivariable Functions and Partial Derivatives, Multiple Integrals, Integration on vector fields

MATH201 Linear Algebra: Matrices and System of Equations, Systems of Linear Equations, Row Echelon Form, Matrix Algebra, Elementary Matrices, Determinants, Vector Spaces, Subspaces, Linear Independence, Basis and Dimension, Change of Basis, Row Space end Column Space, Ortogonallik, Orthogonal Subspaces, Orthonormal Sets, The Gram-Schmidt Orthogonalization Process, Eigenvalues and Eigen vectors, Diagonalization

MATH202 Differential Equations: First Order Differential Equations, Second Order Linear Equations, Higher Order Linear Equations, Series Solutions of Second Order Linear Equations, The Laplace Transform, Systems of First Order Linear Equations

MATH203 Introduction to Probability and Statistics: Product rule, permutation, combination, concept of Probability (Kolmogorov axioms), conditional probability and independency, random variables, Probability density

function, distribution function, discrete distributions: Bernoulli, Binomial, Poisson, continuous distributions: Normal, Gamma, Exponential, Expectation, Moment generating function, mean, variance, standard deviation, covariance, correlation, Chebchev's inequality, Estimator and its properties, maximum likelihood estimators, Confidence intervals, Hypothesis testing, One and two sample test for means, Regression.

MATH205 Numerical Analysis: Description of Numerical Methods and application of them particularly in engineering. Error analyses in numerical methods, analitical solutions, numerical methods for the solution of systems (lineer and non linear), approximation methods, interpolation, linear regression, numerical integration.

NS102 Physics: Vectors. Motion in one and two dimensions. Newton's laws and its applications. Work and energy. Conservation of mechanical energy. Momentum and motion of systems. Static equilibrium of rigid bodies. Rotation and angular momentum. Newton's law universal gravitation.

NS104 General Chemistry: The scope of chemistry and stoichiometry, atoms and the atomic theories, the periodic table and some atomic properties, chemical bonding, molecular geometry, gases and gas laws, liquids, solids, solutions and their physical properties, thermochemistry, principles of chemical equilibrium, acids and bases, thermodynamic.

NS105 Physics II: Coulomb laws and electrical field. Gauss law. Electrical potential. Capacitance. Electrostatic energy and properties of insulators. Current and resistance. DC circuits. The magnetic field. Sources of magnetic field. Faradays law. Inductance. Magnetic field in the matter. Electro Magnetic oscillations and AC circuits. Maxwells equations and electromagnetic waves

Course Catalog Descriptions for Required Courses taken at ITU:

ATA 101 Atatürk's Principles and History of Turkish Revolution I: A definition of Revolution/Renovation. The aim and the importance of the Turkish history of renovation. General state of the Ottoman Empire, the reason for the decline. Efforts to save the Ottoman Empire. The current ideals. The First World War. Societies. Mustafa Kemal in Anatolia and the Congresses. The opening of the Great Turkish National Assembly. Reactions to the National Government. National and International policy. The Mudanya treaty. Lousanne conference.

ATA 102 Atatürk's Principles and History of Turkish Revolution II: The declaration of the Republic. The importance of the leader and the staff in the revolution. Constitutional solutions to the problems related to the Lausanne Conference. The participation of Turkey in pacts and in international organizations. Reactions to the new governmental structure. Trials in the multi party system. The Home and foreign policy of the Republic of Turkey. Atatürk s foreign policy to inspire confidence in the future of Turkey. Kemalism: the Principles of Atatürk.

DAN 301 Career Consultancy: In this course, academic advisors will provide consultancy to students regarding their career preferences. Differences between making a career in academia and industry will be analyzed and the students will be informed so that they can make the optimum career choices that will fit their character the best.

EHB 311E Introduction to Electronics Laboratory: DC Power Supplies, DC characteristics of BJTs and MOSFETs, transistorised amplifiers, linear applications of operational amplifiers, lojic gates and flipflops, non-linear applications of operational amplifiers

EHB 313E Electromagnetic Waves: Maxwell's equations, Wave concept and time dependent wave equation, Time harmonic waves, Phasor (complex) representation, Helmholtz equation and it's solutions. Monochromatic plane waves. Polarization. Reflection and refraction of plane waves from planar boundaries. Wave-guides, Mode and cut-off frequency concepts

EHB 315E Digital Signal Processing: Introduction to discrete-time systems, and digital signal processing. Discrete time linear systems, difference equations, discrete convolution, stability. Discrete-time Fourier transform, analog-to-digital and digital-to-analog conversion, örnekleme. z-transform. Discrete Fourier transform (DFT). Fast Fourier transform (FFT). Digital filter design and implementation. Fundamentals of statistical signal processing. Random processes and power spectrum. Wiener filter. Fundamentals of adaptive filtering. Steepest descent and LMS algorithms. Fundamentals of time-frequency analysis. Short-time-Fourier Transform (STFT). Spectrogram. Introductionto time-scale analysis and wavelet transforms

EHB 322E Digital Electronic Circuits: Introduction and basic definitions, NMOS and CMOS inverters and their static and dynamic behaviors, NOR and NAND gates, complex static gates, pass logic (NMOS and CMOS), flip-flops, synchronization of digital electronic circuits, dynamic gates: cascading methods; domino, NORA, zipper logics, semiconductor memories: ROM, static and dynamic RAM, gate arrays:

EHB 335E Analog Electronic Circuits: Frequency response: Bode diagrams, low and high frequency responses, transistor internal capacitors, transition frequency, Miller theorem. Wideband amplifiers: Gain-bandwidth product, compensation, cascode amplifier, differential amplifier. Feedback: Definitions, types, effects, negative feedback topologies. Stability in feedback amplifiers: criteria, Bode and Nyquist analyses. Pulse response of amplifiers: Rise time, tilt, ringing. Oscillators: Barkhausen criterion, sinusoidal oscillators, relaxation oscillators.

EHB 351E Analog Communications: Introduction to communication systems, modulation techniques, limitations in communication. Spectral analysis. Energy and power spectral density. Transmission of signals over linear systems. The amplitude modulation (AM) techniques: Carrier amplitude modulation, suppressed carrier double sideband modulation, single sideband modulation, vestigial sideband modulation. Amplitude modulators, demodulators. Exponential modulation techniques: Frequency and phase (FM, PM) modulation. Frequency modulators, demodulators. Frequency division multiplexing (FDM). AM radio broadcasting, FM radio broadcasting, superheterodyne receivers. Stereo FM. Television broadcasting.

EHB 352E Digital Communications: Sampling theorem, Nyquist criterion, ideal, natural and flat-top sampling. Pulse modulation techniques: Pulse amplitude modulation, pulse code modulation, quantization, delta modulation, differential pulse code modulation. Baseband data transmission: intersymbol interference, Nyquist channel, bandwidth efficiency. Signal-space analysis, error performance analysis. Binary digital modulation techniques: Binary amplitude shift keying, binary frequency and phase shift keying. M-li bant geçiren modülasyon, enformasyon ve entropi kavramlarına giriş.

EHB 362E Microwave Engineering: Current and voltage waves in TEM mode transmission lines, frequency and time domain analysis, power and energy flow, impedance matching. Smith Chart, microstrip lines, pulse transmission on lines. Basic principles of circuit analysis by S parameters. Basic properties of microwave radio propagation and introduction to antennas

EHB 4901E: Electronics and Communications Engineering Design I: Students form project groups and prepare project proposals for their senior design project under the supervision of their project advisors. They submit their proposals once they receive the approval of their project advisors. At the end of the semester, students also submit the project logbook, which contains a summary of all the actions taken during the semester regarding the project.

EHB 4902E: Electronics and Communications Engineering Design II: Students implement the project proposal that they chose for their senior design work. At mid-semester, project interim report and project logbook should be submitted. At the end of the semester, students should finish the final project report and the final project logbook. Project groups present their senior design work in front of a committee composed of department academicians.

KON 317E Control Systems: Signals and Systems, Feedback, Modeling and transfer function of systems, Modeling of mechanical and electromechanical systems, Modeling of Electrical systems, Modeling of Thermal systems, Time domain criterions, Stability analysis, Root-locus method, Controller structures and PID controller, Frequency domain analysis, Nyquist diagram and stability criterion.

TUR 101 Turkish I: Definition of Language, Language and Thought, Language and Culture, World Languages (In Point of Origin and Structure), The Significance of Turkish Language among World Languages, The Historical Development of Turkish Language, The Structure of Turkish Language, Turkish Phonetics, Todays Turkish Language,The Act of Writing and the Rules of Writing (Orthography), Spelling Rules, The Right Expression of Thought, Scientific Language and Turkish as a Scientific Language, Turkish Poetry and Poetry Language.

TUR 102 Turkish II: Written Expression, Method and Planning of Written Expression, Writing Exercise, Scientific Texts (Article-Report-Critic), Official Texts (Petition-Resume), Genres of Literature, Essay, Column, Travel Writing, Biography, Story, Novel, Verbal Literature, Verbal Expression and Communication

ITU 5th Semester Basic Sciences (TB) Elective Courses:

BIO 301E	Fundamentals of Biology
EHB 227E	Introduction to Optics
EHB 235E	Theory of Complex Functions
FIZ 201E	Modern Physics

ITU 5th Semester Core Engineering (TM) Elective Courses:

BLG 368E	Operations Research
DNK 201E	Dynamics
ELK 214E	Electromech.Energy Conversion
ELK 234E	Thermodynamics &Hydrodynamics
KON 224E	Measurement&Instrumentation

ITU 6th Semester Human and Society (İTB) Elective Courses:
See the list of courses in ITU Undergraduate Catalog.
http://www.sis.itu.edu.tr/tr/dersplan/plan/EHBE/20181063.html

ITU 6th Semester Engineering Technical (MT) Elective I Courses:

EHB 312E	Analog Elec. Circuits Lab.
EHB 324E	Logic Design Lab.

ITU 6th Semester Engineering Technical (MT) Elective II Courses:

BLG 212E	Microprocessor Systems
EHB 332E	Network Synthesis
EHB 334E	Random Signals and Noise

ITU 7th Semester Human and Society (İTB) Elective Courses:
See the list of courses in ITU Undergraduate Catalog.
http://www.sis.itu.edu.tr/tr/dersplan/plan/EHBE/20181063.html

ITU 7th Semester Engineering Technical (MT) Elective Courses:

BLG 212E	Microprocessor Systems
BLG 252E	Object Oriented Programming
BLG 441E	R-Time Sys.Dsg by Dig.Sig.Proc
EHB 326E	Intr.to Embedded Systems
EHB 328E	Machine Learning for Sig.Proc.
EHB 405E	Analog Integrated Circuits
EHB 413E	VLSI Circuit Design I
EHB 415E	Data Communications
EHB 417E	RF Microelectronics
EHB 418E	RF Electronics Applications
EHB 419E	Digital System Design
EHB 420E	Artificial Neural Networks
EHB 421E	Intr. to Medical Electronics
EHB 422E	The Orgn &Snsing M.of Bio.Sig.
EHB 424E	Ultrasaund and App.in Medicine
EHB 436E	Digital System Design Applic.
EHB 442E	Semiconductor Devices
EHB 451E	Active Microwave Circuits
EHB 453E	Intr.to Mobile Communications
EHB 454E	Communication Theory
EHB 456E	Antennas
EHB 458E	Micrwv Measurement Meth.& App.
EHB 473E	Microwave and RF Communication
EHB 474E	Introduction to Optimization
EHB 477E	Fundm.of Electrmgn.Compt.
EHB 481E	Des.&Applic.of Basic Comm.Sys.

ELK 331E Power Electronic Circuits

ITU 8th Semester Human and Society (İTB) Elective Courses:

EKO 201E Economics
HUK 201 İş Hukuku

ITU 8th Semester Engineering Technical (MT) Elective Courses:

EHB 334E Random Signals and Noise
EHB 408E Wireless Com.Networks
EHB 425E VLSI Circuit Design II
EHB 426E Microelectr.Analog Syst.Design
EHB 427E Microelectronics Technology
EHB 428E Industrial Electronics
EHB 429E Communic.Elect.Circuits
EHB 431E Design & Appl.Digital Com.Sys.
EHB 433E Digital Filters and Systems
EHB 437E Biomedical Devices
EHB 440E Comp.Aided Devices in Medicine
EHB 445E Medical Instr.,Design and App.
EHB 463E Communication Systems
EHB 464E Satellite Communications
EHB 465E Fiberoptic Com. Systems
EHB 466E Remote Sensing
EHB 467E Radar Systems
EHB 468E Princ of Elec.Compt.Measurmnts
EHB 472E Image Processing Fundamentals
EHB 475E Digital Speech Processing
KON 424E Mod.&Cntrl of Biological Sys.

ITU 8th Semester Arts (SNT) Elective Courses:

SNT 103E Drawing
SNT 104E Mythology and Art
SNT 105E Film Art
SNT 106E Traditional Turkish Art&Crafts
SNT 107E Ancient Civilizat.in Anatolia
SNT 112E Theater
SNT 113E Art and Interpretation
SNT 114E Contemporary Art
SNT 116E The Art of Communication
SNT 117E Jazz Appreciation
SNT 121E World Music Cultures
SNT 123E Film Production
SNT 211E Istanbul:Hist.,Art and Society
SNT 212E Art,Culture and Society
SNT 215E Balkan Musics
SNT 226E Philosophy of Art
SNT 227E Sound and Society