♦ المقررات الدراسية العامة لقسم هندسة الحاسب

أولا: قوائم مسميات المقررات الدراسية للمرحلة العامة: -

The 1st: List of General Courses: -

Humanities Courses — مقررات العلوم الإنسانية

Course No.	Course name	Prerequisite المتطلبات	Credits الوحدات	اسم المقرر	رقم المقرر
GH141	English I	/	3	اللغة الإنجليزية 1	ع إ 141
GH142	English II	GH141	3	اللغة الإنجليزية 2	ع إ 142
GH150	Arabic I	/	2	اللغة العربية 1	ع إ 150
GH151	Arabic II	GH150	1	اللغة العربية 2	ع إ 151
GH152	Technical Writing	GH151	1	كتابة التقارير الفنية	ع إ 152

General Science Courses — مقررات العلوم الاساسية العام

Course No.	Course name	Prerequisite المتطلبات	Credits الوحدات	اسم المقرر	رقم المقرر
GS101	Mathematics I	/	3	الرياضيات 1	ع ع 101
GS102	Mathematics II	GS101	4	الرياضيات 2	ع ع 102
GS111	Physics I	/	3	الفيزياء 1	ع ع 111
GS112	Physics II	GS111	3	الفيزياء 2	ع ع 112
GS112L	Physics Lab	GS111	1	فيزياء معمل	ع ع 112 م
GS115	Chemistry	/	3	الكيمياء العامة	ع ع 115
GS115L	Chemistry Lab	/	1	الكيمياء معمل	ع ع 115 م
GS203	Mathematics III	GS102	3	الرياضيات 3	ع ع 203
GS204	Mathematics IV	GS102	3	الرياضيات 4	ع ع 204
GS206	Probability & Statistics	/	3	الإحصاء والاحتمالات	ع ع 206
M305	Advanced Mathematics	GS204	3	رياضيات متقدمة	ر 305
PH317	Modern Physics	GS112	3	الفيزياء المتقدمة	ف 317

General Engineering Courses

مقررات العلوم الهندسية العامة

Course No.	Course name	Prerequisite المتطلبات	Credits الوحدات	اسم المقرر	رقم المقرر
GE121	Engineering Mechanics I	/	3	ميكانيكا هندسية 1	هـ ع121
GE125	Engineering Graphics	/	2	الهندسة الوصفية	هـ ع 125
GE127	Engineering Drawing	/	2	الرسم الهندسي	هـ ع 127
GE129	Workshop Technology	/	2	تقنية الورش	هـ ع 129
GE129 L	Workshop Technology Lab	/	1	معمل تقنية الورش	هـ ع 129 م
GE133	Properties of Materials	GS101 + GS111 + GS115	3	خواص المواد	هـ ع 133
GE222	Engineering Mechanics II	GE121	3	ميكانيكا هندسية2	هـ ع 222

ثانيا: قائمة مسميات المقررات الدراسية الملزمة لجميع طلبة قسم هندسة الحاسب:-

The 2nd: List of Departmental Compulsory Courses: -

Course No.	Course name	Prerequisite المتطلبات	Credits الوحدات	اسم المقرر	رقم المقرر
EC201	Systems & Circuits I	GS102 + GS112	3	دوائر ومنظومات كهربائية 1	هـ حس 201
EC202	Systems & Circuits II	EC201	3	دوائر ومنظومات كهربائية 2	هـ حس 202
EC251	Intro. to Computer Programming	GS102 + GS112	3	مقدمة برمجة الحاسوب	هـ حس 251
EC252	Object Oriented Programming	EC251	3	البرمجة الكائنية التوجه	هـ حس 252
EC301	Linear Systems	EC310 + GS204	3	أنظمة خطية	هـ حس 301
EC310	Electronic Material & Devices	EC201	3	مواد ونبائط كهربائية	هـ حس 310
EC312	Electronic Circuits I	EC310 + EC201	3	دوائر إلكترونية 1	هـ حس 312
EC312L	Electronic Circuits I Lab.	EC310	1	معمل دوائر إلكترونية 1	هـ حس 312 م

Course No.	Course name	Prerequisite المتطلبات	Credits الوحدات	اسم المقرر	رقم المقرر
EC313	Electronic Circuits II.	EC312 + EC312L	3	دوائر إلكترونية 2	هـ حس 313
EC313L	Electronic Circuits II Lab.	EC312 + EC312L	1	معمل دوائر إلكترونية 2	هـ حس 313 م
EC331	Intro. To Communication Systems	EC301 + GS206	3	مقدمة منظومات الاتصالات	هـ حس 331
EC331L	Intro. To Communication Systems Lab.	EC301 + GS206	1	معمل مقدمة منظومات الاتصالات	هـ حس 331 م
EC351	Intro. to Computer Systems	EC251 + EC381	3	مقدمة للأنظمة الحاسوبية	هـ حس 351
EC352	Data Structures & Algorithms I	EC252	3	بنية البيانات والخوارزميات	هـ حس 352
EC372	Intro. to Numerical Analysis	EC251 + GS204	3	مقدمة التحليل العددي	هـ حس 372
EC381	Digital Systems I	EC201	3	منظومات رقمية I	هـ حس 381
EC381L	Digital Systems I Lab.	EC201	1	معمل منظومات رقمية	هـ حس 381م
EC383	Digital Systems II	EC381 + EC381L	3	منظومات رقمية II	هـ حس 383
EC383L	Digital Systems II Lab.	EC381 + EC381L	1	معمل منظومات رقمية	هـ حس 383م
EC433	Computer Networks	EC331 + EC331L	3	شبكات حاسوبية	هـ حس 433
EC433L	Computer Networks Lab.	EC331 + EC331L	1	معمل شبكات حاسوبية	هـ حس 433 م
EC441	Data Acquisition & Control I	EC313 + EC202 + EC313L	3	استحصال البيانات للقياس والتحكم	هـ حس 441
EC441L	Data Acquisition & Control I Lab.	EC313 + EC202 + EC313L	1	معمل استحصال البيانات للقياس والتحكم 1	هـ حس 441 م
EC446	Analog Control Systems	EC313 + EC301 + EC313L	3	منظومات التحكم التماثلي	هـ حس 446
EC446L	Analog Control Systems Lab.	EC313 + EC301 + EC313L	1	معمل منظومات التحكم التماثلي	هـ حس 446 م
EC448	Digital Signal Processing	EC301 + EC372	3	معالجة الاشارات الرقمية	هـ حس 448

EC451	Operating Systems	EC352 + EC383 + EC351	3	نظم التشغيل	هـ حس 451
EC482	Microprocessor Systems	EC351 + EC383 + EC383L	3	المعالجات الدقيقة	هـ حس 482
EC482L	Microprocessor Systems Lab.	EC351 + EC383 + EC383L	1	معمل المعالجات الدقيقة	هـ حس 482 م
EC483	Microprocessor & Embedded systems	EC482 + EC451 EC482L	3	نظم الحواسيب الصغيرة والدقيقة	هـ حس 483
EC499	B.Sc. Project	EC483 + EC441 + EC441L	4	مشروع التخرج	هـ حس 499

ثالثا: قائمة مسميات المقررات الاختيارية لقسم هندسة الحاسب:-

The 3rd: List of Departmental Elective Courses: -

Course No.	Course name	Prerequisite المتطلبات	Credits الوحدات	اسم المقرر	رقم المقرر
EC501	Adaptive Signal Processing	EC448 + EC547	3	المعالجة التكيفية للإشارات	هـ حس 501
EC511	Solid State Electronics	EC310	3	الالكترونيات في الحالة الجامدة	هـ حس 511
EC512	Semiconductor Device Manufacturing	EC310	3	تصنيع أشباه الموصلات	هـ حس 512
EC513	Optoelectronic Devices	EC313	3	الاجهزة الالكترونية الضوئية	هـ حس 513
EC514	Digital Electronics	EC313 + EC381	3	الالكترونيات الرقمية	هـ حس 514
EC520	Internet Security	EC433	3	حماية شبكة المعلومات	هـ حس 520
EC521	Coding Theory	EC331 + EC381	3	نظرية التشفير	هـ حس 521
EC522	TCP/IP Protocol Design and Programming	EC433	3	تصميم وبرمجة بروتوكول TCP/IP	هـ حس 522
EC530	High speed Networks	EC433	3	شبكات عالية السرعة	هـ حس 530
EC532	Optical Fiber Communication	EC331	3	اتصالات الالياف البصرية	هـ حس 532
EC533	Internet & Security	EC433	3	حماية الانترنت	هـ حس 533

EC534	Satellite Communication	EC331	3	اتصالات عبر القمر الصناعي	هـ حس 534
EC540	System Identification	EC446	3	تحديد النظام	هـ حس 540
EC544	Fuzzy Engineering	EC446	3	هندسة غامضة	هـ حس 544
EC546	Nonlinear Control	EC446	3	التحكم غير الخطي	هـ حس 546
EC547	Digital Control	EC446	3	التحكم الرقمي	هـ حس 547
EC548	Distributed Real Time Control Sys	EC451 + EC433	3	توزيع انظمة التحكم في الوقت الحقيقي	هـ حس 548
EC550	Topics in S/W Engineering	EC451 + EC482	3	مواضيع في هندسة البرمجيات	هـ حس 550
EC552	Data Structure & Algorithms II	EC352 + EC451	3	هيكلة البيانات والخوارزميات	هـ حس 552
EC554	Program Specification & Verification	EC352 + EC451	3	المواصفات والتحقق للبرمجيات	هـ حس 554
EC555	Software Engineering	EC252 + EC451	3	هندسة برمجيات	هـ حس 555
EC556	Database System Design	EC352 + EC451	3	تصميم انظمة البيانات	هـ حس 556
EC557	Pattern Recognition	EC301 + GS206	3	تمييز الانماط	هـ حس 557
EC558	Artificial Intelligence	EC451 + EC482	3	الذكاء الاصطناعي	هـ حس 558
EC559	Advance Programming using JAVA	EC252 + EC352	3	البرمجة المتقدمة باستخدام جافا	هـ حس 559
EC560	Neural Networks	EC351 + EC446	3	الشبكات العصبية	هـ حس 560
EC565	Computer Based Instrument	EC441	3	أداة حاسوبية	هـ حس 565
EC572	Numerical Analysis II	EC372	3	التحليل العددي 2	هـ حس 572
EC573	Probabilistic Models	EC351 + GS206	3	نماذج احتمالية	هـ حس 573
EC574	Optimization Techniques	EC372	3	تقنيات الاستمثال	هـ حس 574
EC575	Modeling and Simulation	EC451	3	نمدجة ومحاكاة	هـ حس 575
EC577	Robotics	EC547	3	الانسان الالي	هـ حس 577
EC578	Soft Computing & Applications	EC451	3	الحوسبة اللينة وتطبيقاتها	هـ حس 578

EC579	Computer Systems Performance Evaluation	EC451 + EC482	3	تقييم أداء أنظمة الحاسوب	هـ حس 579
EC580	Special Topics in Digital Systems	EC482 + EC451	3	مواضيع خاصة في النظم الرقمية	هـ حس 580
EC582	FPGA Design for Embedded Sys	EC482	3	تصميم FPGA للأنظمة المدمجة	هـ حس 582
EC583	VLSI Systems	EC483	3	أنظمة VLSI	هـ حس 583
EC584	Computer Memory and I/O	EC482	3	ذاكرة الحاسوب وبوابات الادخال والاخراج	هـ حس 584
EC585	Computer Architecture	EC483 + EC451	3	بنية الحاسوب	هـ حس 585
EC586	Computer Graphics	EC372 + EC352	3	الرسومات الحاسوبية	هـ حس 586
EC587	Digital System Testing & Simulations	EC483	3	اختبار ومحكاه نظم رقمية	هـ حس 587
EC588	Switching Theory	EC482	3	نظرية دوائر الاستبدال	هـ حس 588
EC589	Computer Aided Design	EC313 + EC372	3	حوسبة التصميم	هـ حس 589
EC590	Computer & Society	EC451 + EC482	3	المجتمع والحاسوب	هـ حس 590
EC591	Parallel Processing	EC451 + EC482	3	المعالجة المتوازية	هـ حس 591
EC593	Image Processing	EC301	3	معالجة الصور الرقمية	هـ حس 593

♦ المحتوى العلمي للمقررات الدراسية بقسم هندسة الحاسب

EC 201	Systems and Circuits I	3 Credits

Pre-requisite: GS 102 + GS 112

Basic definitions of voltage current and power, Kirchhoff's voltage and current law, Resistive basic circuit analysis, Advanced circuit analysis techniques Capacitors and inductors and their voltage and current relations. And related .power and energy relationship. Natural and step response of first order circuits Natural and step response of second order circuits Sinusoidal steady state response, and AC power calculations

EC 202	System and Circuits II	3 Credits

Pre-requisite: EC 201

Magnetic fields and circuits (Energy conversion, Magnetic fields, Magnetic circuits). Transformers (AC excitation, Transformer operation, Circuit Models, Performance). Principles of electro mechanics (Translational transducers, Rotational transducers, Moving-iron devices). Direct-current machines (DC generators, DC motors). Alternating-current machines (Alternators, Synchronous motors. Induction motors).

EC 251	Introduction to Computer Programming	3 Credits

Pre-requisite: GS 102 + GS 112

Computer organization, main hardware components. Machine language versus high level language. Number systems –representation, conversion, and operations. Arithmetic and logical operations and expressions. Basic programming constructs using C syntax, process, decision and loops. Arrays. Subprograms and modular programming. Input and output techniques. Pointers.

EC 252	Object Oriented Programming	3 Credits

Pre-requisites: EC 251

This course is an introductory course in object-oriented programming. The fundamental concepts of object-oriented programming will be studied. It is assumed that students will be familiar with basic programming concepts and programming logic. No prior knowledge of any particular programming language

is required.

Grades will be assigned based on performance on examinations and programming assignments.

EC 301	Linear Systems	3 Credits

Pre-requisite: EC 310 + GS 204

Introduction. Continuous-time systems. Laplace Transform. Fourier analysis for continuous-time systems. Discrete-time systems. z-Transform. Fourier analysis for discrete-time systems.

EC 310	Electronic Materials and Devices	3 Credits

Pre-requisite: EC 201

Electronics in solids - energy bands, carrier density, mobility, resistivity. P-N junctions -properties (Thermal-equilibrium: Built-in potential barrier, Charge density, minority carrier concentration at equilibrium, Space charge width: depletion layer widths for n-side and p-side, Electric field and Current density of PN junction at equilibrium. Reverse bias and Forward bias), Semiconductor diodes (Zener diode, LED, LASER and photodiodes), diode's applications (Rectification, clamping, clipping, voltage regulator and voltage doubler.), characteristic of BJT and FET transistors.

EC 312	Electronic Circuits I	3 Credits

Pre-requisites: EC 201 + EC 310

BJT and FET Transistors biasing. Stability of BJT and FET transistors, single and multistage BJT and FET amplifiers. Bode plot and transfer function, Frequency-response of single and cascaded amplifiers. IC biasing.

EC 312L	Electronic Circuits I Lab.	1 Credits

Pre-requisite: EC 201 + EC 310

Accompanies EC 312. Some experiments concerning EC 312.

EC 313	Electronics Circuits II	3 Credits

Pre-requisites: EC 312 + EC 312L

Feedback

amplifiers and stability. Operational amplifiers; characteristics and applications. Waveform generators (oscillators; sine, square, triangle waves). Wave shaping circuits (multi-stable, stable multi-vibrators, pulse generators).

EC 313L	Electronic Circuits II Lab	1 Credits

Pre-requisites: EC 312 + EC 312L

Accompanies EC 313.

EC 331	Introduction to Communication Systems	3 Credits

Pre-requisite: EC 301 + GS 206

Spectral analysis. Modulation. Amplitude modulation (AM). Double side band suppressed-carrier (DSB-SC). Single side band (SSB). Frequency division multiplexing (FDM). Angle modulation. Phase and frequency modulation. Pulse Amplitude Modulation (PAM). Pulse Width modulation (PWM). Pulse Position Modulation (PPM). Pulse code modulation (PCM). Multiplexing. Time division multiplexing in PCM. Delta modulation (DM).

EC 331L	Communication Systems Lab.	1 Credits

Pre-requisite: EC 301 + GS 206

Accompanies EC 331

EC 351	Introduction to Computer Systems	3 Credits

Pre-requisites: EC 251 + EC 381

How are programs written in a high-level language, such as C or Java, translated - into the language of the hardware, and how does the hardware execute the resulting program?
What is the interface between the software and the hardware, and how does - software instruct the hardware to perform needed functions?
What determines the performance of a program, and how can a programmer - improve the performance?
What techniques can be used by hardware designers to improve performance? - What techniques can be used by hardware designers to improve energy - efficiency? What can the programmer do to help or hinder energy efficiency?

What are -
the reasons for and the consequences of the recent switch from sequential processing to parallel processing
Since the first commercial computer in 1951, what great ideas did computer - architects come up with that lay the foundation of modern computing?

EC 352	Data Structures and Algorithms	3 Credits

Pre-requisite: EC 252

Packed data structures (arrays and files. Creation and retrieval of stable sparse matrices. Internal sorts algorithms. Basic operations on sequential and random files. External sorts algorithms. Strings). Dynamic data structures (linear and nonlinear. Basic operations on stacks. Arithmetic expressions translation using stacks. Linked list, double linked lists, queues, circular lists. Basic operation and application to simulation problems. Trees. Creation and parsing (traveling) algorithms).

EC 372	Introduction to Numerical	3 Credits

Pre-requisite: EC 251 + GS 204

Computer arithmetic and errors. Conditioning and stability of computations. Real roots finding methods. Methods for solving linear systems: Gaussian elimination, factorization, and iterative methods. Interpolation methods. Approximation by polynomials. Numerical Differentiation and integration, as well as ordinary differential equations.

EC 381	Digital Systems I	3 Credits

Pre-requisite: EC 201

Binary arithmetic. Boolean algebra. Basic logic elements and their characteristics. Combinational logic functions (adders, decoders, multiplexers, etc.) and their implementation. Flip-flops, gate level realization. Asynchronous counters and registers. Introduction to ROM, RAM, and PLAs. Analysis and design of small sequential logic systems. PLDS, FGA.

EC 381L	Digital Systems I Lab.	1 Credits

Pre-requisite: EC 381

Design, implementation and testing of combinational and sequential logic circuits using SSI and MSI logic modules (TTL & CMOS) (e.g., adders, counters, encoders, decoders, multiplexers, flip flops... etc.)
Accompanies EC 381

EC 383	Digital Systems II	3 Credits

Pre-requisite: EC 381 + EC 381L

Digital systems. Register Transfer Level Design. Data path and control unit. Control unit structure: hardwired, micro-programmed. ALU structure - integer & floating-point arithmetic functions. CPU structure - basic instructions control design. ALU & simple I/O systems.

EC 383L	Digital Systems II Lab.	1 Credits

Pre-requisites: EC 381 + EC 381L

Design, Implementation, and Testing of Register Level Digital Systems. Emphasizing the use of MSI & LSI devices. Accompanies EC 383.

EC 433	Computer Networks	3 Credits

Pre-requisites: EC 331 + EC331L

This course will provide an introduction to computer networking technologies, including architectures, protocols, and interfaces. Addressing, routing, flow control, queuing, and routing will be discussed. It covers the concepts, vocabulary, design issues, and techniques currently used in the area of computer networks. Topics include history and evolution, transmission media, interconnection topology, control methods, protocols, types of nodes, network interfaces, performance analysis, diagnosis and maintenance, taxonomy, bridges, and gateways.

EC 433L	Computer Networks Lab.	1 Credits

Pre-requisite: EC 331 + EC 331L
Accompanies EC 433

EC 441	Data Acquisition and Control I	3 Credits

Pre-requisite: EC 313 + EC 313L + EC 202

This course covers the organization of data acquisition channels with emphasis on characteristics of channel elements and computation of error budget. Topics includes sensors and transducers, instrumentation amplifiers, signal conditioning techniques, loading effects, considerations of bandwidth and stability, recovery of signals from noise, correlation and sampling techniques, Active and digital filters, in addition to A/D, D/A conversion methods. Also, the course highlights interference and noise, common mode rejection techniques for elimination of ground loops, screening, and guard techniques.

EC 441L	Data Acquisition and Control Lab.	1 Credits

Pre-requisite: EC 313 + EC 313L + EC 202
Accompanies EC 441.

EC 446	Analog Control Systems	3 Credits

Pre-requisite: EC 313 + EC 313L + EC 301
Feedback Control systems concepts, speed and position control systems. Frequency response techniques - use of Bode, inverse Nyquist. root-locus and Nichols charts. Performance criteria, errors, sensitivity, stability and time response. Compensation techniques. State-space representation, analysis and design.

EC 446L	Analog Control Systems Lab.	1 Credits

Pre-requisites: EC 313 + EC 313L + EC 301
Accompanies EC 446.

EC 448	Digital Signal Processing	3 Credits

Pre-requisites: EC 301 + EC 372

Concept of orthogonal function. Fourier series, Fourier transform. Fast Fourier transform. Analysis of discrete time systems. Frequency response, impulse response. Design of FIR filters. Window technique. Frequency sampling and optical filters. Design of MR filters using analog techniques. Butterworth and Chebyshev filters.

EC 451	Operating Systems	3 Credits

Pre-requisites: EC 352 + EC 351 + EC 482

Computer systems organization. Types and functions of operating systems. Process management, Memory management, I/O management. Case studies of typical operating systems (Unix, DOS).

EC 482	Microprocessor Systems	3 Credits

Pre-requisites: EC 383 + EC 383L + EC 351

Microprocessor structure. Internal bus organization. Study of instruction set and its execution process with detailed timing analysis. Various microprocessor states. I/O processors; polled interrupt and DMA driven. System bus concept and simple interface design. Case studies of the contemporary microprocessors.

EC 482L	Microprocessor Systems Lab.	1 Credits

Pre-requisites: EC 383 + EC 383L + EC 351

Accompanies EC 482

EC 483	Microprocessor and Embedded Systems	3 Credits

Pre-requisites: EC 482 + EC 482L + EC 451

This course is a continuation of the Microprocessor Systems. Include advanced contemporary processors architectures, memory interface, cache and memory management. Embedded systems and microcontroller technology, Microcontroller Architecture, internal RAM and Registers, microcontroller instructions and programming, interfacing the microcontroller with external memory and I/O devices, case study of an embedded system.

EC 499	B.Sc. Project	4 Credits

Pre-requisites: EC 483 + EC 441 + EC 441L

Professional problem - solving methods developed through intensive group and/or individual studies of significant engineering projects. Use of analytic, computer, and experimental techniques where applicable. Lecture and lab. work.

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EC 501	Adaptive Signal Processing	3 Credits

Pre-requisites: EC447

Modelling: Room acoustics and multipath propagation.
Adaptive filter structures: FIR, IIR, and filter banks. Adaptation and tracking algorithms: RLS and Kalman-based adaptation. Hyper model-based design of Kalman-based trackers and of algorithms with constant gains. LMS and RLS revisited. Analysis of adaptation speed and convergence. Frequency-domain adaptation. Effects of bad excitation and non-stationary signals.
Implementation: Practical aspects, numerical effects, fixed-point calculations, the use of signal processors.

EC 511	Solid State Electronics	3 Credits

Pre-requisites: EC313

Semiconductor materials, crystal lattice, energy bands and concentrations, carrier transport phenomena, p-n junction diode, different kinds if transistors; bipolar, microwave, power, switching and hetero-junction. Metal-semiconductor contacts, IFET, MESFET, MIS diode, MOS diode, charge-coupled device, MOSFET, nonvolatile memory devices, LED, semiconductor lasers, photoconductors, photodiodes, avalanche photodiodes, phototransistors.

EC 512	Semiconductor Devices	3 Credits

Pre-requisites: EC313

Elements of solid-state physics. Light modulation. Display device, lasers, thermal detectors, photon devices, detector performance parameters, fiber optical wave devices. Crystal growth and epitaxy. Oxidation and film decomposition. Diffusion

and ion implantation. Lithography and etching. Integrated devices such as passive components, bipolar technology, MOSFET technology, MESFET technology.

EC 513	Optoelectronic Devices	3 Credits

Pre-requisites: EC313

Electronic properties of optical semiconductors, effect of temperature and pressure on bandgap, carrier scattering phenomena, density of carries in intrinsic and extrinsic semiconductors. Optical processes in Semiconductors. High speed lasers. strained Quantum Well Lasers. Quantum wire lasers, Quantum dot lasers current. Topics in semiconductor Lasers.

EC 514	Digital Electronics	3 Credits

Pre-requisites: EC313 + EC381

Steady state and transient analysis of RTL, DTL, TTL, I2L, ECL, and CMOS integrated circuits. Study of internal circuitry of memories (RAM, EPROM etc.). CCD structures, interfacing of IC families and discrete circuits.

EC 520	Internet Security	3 Credits

Pre-requisites: EC 433

Overview: computer hacking. Infections points. Defense mechanisms. Encryption & decryption basics. Secure encryption methods. Software attached security. Designing secure operating systems. Database security. Confidentiality, Integrity and availability. Computer communication networks security.

EC 521	Coding Theory	3 Credits

Pre-requisites: EC 331 + EC 381

The Hamming and Lee Metrics, Description of Linear Block Codes by Matrices, Description of Linear Tree codes by Matrices, The Standard Array, step-by-step Decoding of Block Codes, Modular Representation of Linear Block codes, Linear Block Codes Equivalence, Maximum-Distance-Separable Codes. Important Linear Block Codes: The Hamming codes, Optimum codes for the Binary Symmetric Channel, binary Codes with large Minimum Distance Read-Muller Codes.

EC 522	TCP/IP Protocol Design and Programming	3 Credits

Pre-requisites: EC 433

TCP/IP protocol suite in details (network, transport and application layers), protocol formats and interactions, internet routing, IPv6, mobile IP, HMIP, Internet QoSs (Int-Serv, Diff-Serv, RSVP, IPoverATM), and Security (IPsec, EDS, RSA) protocols, architectures. Monitor and simulate internet protocols.

EC 530	High Speed Networks	3 Credits

Pre-requisites: EC 433

Protocol, Architectures, and technology of wired and wireless high-speed network, it includes Physical layer: Fiber-optics, single-mode and multimode technologies; Medium access control protocol, flow control and error detection. High-speed packet-switch architectures, buffering approaches and traffic Scheduling. Fast and Giga-bit Ethernets, IEEE 802.11 Wireless LAN, Point to Points WANS and ATM switched WANS.

EC 532	Optical Fiber Communications	3 Credits

Pre-requisites: EC 331

Optical fiber communication system, advantages of optical fiber communication, spectrum of light, ray theory transmission, electromagnetic mode theory for optical propagation, cylindrical fiber, single-mode and multimode fibers, lenses, numerical aperture. Delay: -Dispersion and Distortion. attenuation and modulation frequency. optical bandwidth. Graded index fiber. Optical fiber in networking.

EC 534	Satellite Commination	3 Credits

Pre-requisites: EC 331

Satellite communication systems. Satellites. Earth stations. Propagation models and Link budget design. Modulation, coding and encryption techniques. Management and regulations of satellite communication systems. Digital

broadcasting.
Internet using satellite networks. Mobile cellular satellite communications.

EC 540	System Identification	3 Credits

Pre-requisites: EC 446

Parametric and nonparametric system identification. Experimental planning. Selection of model structure, parameters estimation. Least squares, stochastic interpretation. Minimum-variance prediction and control. Validation. Experimental design.

EC 544	Fuzzy Engineering	3 Credits

Pre-requisites: EC 446

Fuzzy function approximation. Learning in SAMS: unsupervised clustering and supervised gradient descent. Fuzzy control and CHAOS.
Fuzzy throttle controller. Control surface learning. Fuzzy signal processing. Fuzzy hardware. Fuzzy adaptive resonance theory.

EC 546	Nonlinear Control	3 Credits

Pre-requisites: EC 446

Phase plane construction: the isocline Lienard's methods. Describing functions and its applications. Lyapunov's Stability theory. Popov stability criterion.

EC 547	Digital Control	3 Credits

Pre-requisites: EC 446 + EC 446L

Introduction to the analysis and design of discrete-time feedback control systems. Topics include: Sampling and reconstruction of signals: S/H circuit, A/D, and D/A conversions, review of the z-transform and its properties, modified Z-transform. Transfer Functions, Block Diagrams, and SFG for digital control systems. State-Variable Technique applied to digital control systems. Controllability, Observability, and Stability. Time-Domain and Z-Domain Analysis, comparison between continuous-data and sampled-data system responses are made, steady-state analysis and root locus. Frequency-Domain Analysis of digital control systems (Nyquist criterion, Bode plot). Design of Discrete-Data Control Systems (PID design, Phase-Lead and Phase Lag Controllers, Disturbance rejection, Pole-Zero cancellation, Deadbeat-response design). State-space feedback control and observer design, pole placement, state estimator design. Quantization effects.

EC 548	Distributed Real Time Control Systems	3 Credits

Pre-requisites: EC 451 + EC 482

Principles of distributed computing; architectures and middleware; servers, processes, and virtualization; upper-layer network protocols, inter-process communication and remote procedure calling; concurrency, synchronization and distributed algorithms, dependable distributed systems and fault tolerance.

EC 550	Topics in Software Engineering	3 Credits

Pre-requisites: EC 451 + EC 482

Advanced topics in the area of Industrial applications of computers and microprocessors in process control.

EC 552	Data Structures and Algorithms II	3 Credits

Pre-requisites: EC 352 + EC 451

Linked stacks and queues - application: the available space list, polynomial arithmetic. Recursion: divide and conquer, postponing the work-backtracking, look-ahead. Binary trees: tree sort, building a binary search tree, height balance - AVL trees, heaps. Expansion trees: Polish notation, Pascal implementation. Graphs: computer representation, graph traversal, topological sorting, shortest path algorithm.

EC 556	Database systems design	3 Credits

Pre-requisites: EC 352 + EC 451

Part 1: Databases and Database Users (Database System Concepts and Architecture, Data Modeling Using the Entity Relationship Model, Enhanced Entity Relationship and UML Modeling). Part 2: (RELATIONAL MODEL: CONCEPTS, CONSTRAINTS, LANGUAGES, DESIGN, AND PROGRAMMING. The Relational Data Model and Relational Database Constraints, The Relational Algebra and Relational Calculus, Relational Database Design by ER and EER to Relational Mapping, sQL: Schema Definition, Basic Constraints, and Queries, More SQL: Assertions, Views, and Programming Techniques).

EC 555	Software Engineering	3 Credits

Pre-requisites: EC 252 + EC 451

Introduction to Software Engineering: Professional software development, Software engineering ethics. Software Process: Software process models, Process

activities, Coping with change, The Rational Unified Process. Agile Software Development: Agile methods, Plan-driven and agile development, Extreme programming. Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirement's specification, Requirements engineering processes, Requirement's elicitation and analysis, Requirement's validation, Requirements management. System Modeling: Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering. Architectural Design: Architectural design decisions, Architectural views, Architectural patterns, Application architectures.

EC 557	Pattern Recognition	3 Credits

Pre-requisites: EC 301

Sensing, Segmentation, Feature extraction, training and Classification. The Bayesian decision theory, Maximum likelihood and Bayesian parameter estimation of known parametric form probability density functions, Nonparametric techniques of pattern classifications, Linear discriminate functions, and Neural networks, The Unsupervised learning and clustering.

EC 558	Artificial Intelligence	3 Credits

Pre-requisites: EC 451 + EC 482

Artificial intelligence (AI) is a research field that studies how to realize the intelligent human behaviors on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously.

The main research topics in AI include: problem solving, reasoning, planning, natural language understanding, computer vision, automatic programming, machine learning, and so on.

EC 559	Advance Programming using JAVA	3 Credits

Pre-requisites: EC 451 + EC 483

Advanced topics about JAVA micro-edition (JME) and JAVA enterprise edition (JEE).

EC 560	Neural Networks	3 Credits

Pre-requisites: EC 351 + EC 446

Biological neural networks and simple models. The artificial neuron models. Hopfield nets. Energy functions and optimization. Perceptions and threshold logic machines. Multiplayer networks and its applications.

propagation. Recurrent nets. Tress structured networks. Unsupervised learning. Hebbian learning. Principal component analysis. Competitive learning. Feature mapping. Self-organizing maps. Adaptive resonance theory. Hardware realization of ANNs.

EC 572	Numerical Analysis II	3 Credits

Pre-requisites: EC372

Sets of nonlinear equations: Newton method and its modifications. Large systems of linear equations: sparse matrix methods. Quadratures: Taylor, Runge-Kutta and multiroots methods. Adaptive quadratures. Initial values and boundary values problems. Stiff differential equations and stability.

EC 573	Probabilistic Models	3 Credits

Pre-requisites: EC 351 + GS 206

Introduction to probability theory. Random processes. Markov chains. The basic structure of queuing systems. Performance measures of a queuing systems. Little's formula. Birth and death process models. Examples of queuing systems in equilibrium. Queuing systems with finite and infinite server and population models. Erlang blocking formulae. Method of stages.

EC 574	Optimization Techniques	3 Credits

Pre-requisites: EC 372

Linear Programming: LP Formulations, Graphical and algebraic methods for solving LP's with many variables, Simplex and dual Simplex methods, Duality theory and sensitivity analysis, transportation problems, network problems and assignment problems. Nonlinear Programming: Single and multivariable unconstrained optimization, line search methods including bisection, equal interval, golden-section search. Parabolic interpolation and Newton methods; gradient optimization techniques and application including steepest descent and conjugate gradient methods. Lagrange multipliers for constrained optimization. Convexity, basic solutions, extreme values, duality, convergence rate, Lagrangian, KKT conditions. Optimization Solvers: MATLAB Optimization Tool Box, MS Excel Solver, AMPL and others.

EC 575	Modeling and Simulation	3 Credits

Pre-requisites: EC 372 + EC 451

An introduction to modeling and simulation. Discrete and continues models. Discrete-event simulation: event-oriented and process-oriented approaches, time advance mechanisms, queues, queues disciplines and stopping rules, single-server model - case study. More complex models: case studies - memory model, simple batch computer system model. Monte-Carlo simulation. Probability concepts in modeling and simulation. Simulation languages - short review of GPSS and SIMSCRIPT.

EC 577	Intelligent Control Systems	3 Credits

Pre-requisites: EC 447

Robot Dynamics: Dynamics of flexible and rigid robots, linear parameterization, globally convergent algorithm, singular perturbations, time delay problems. Multiple and redundant robots, computational approaches to robot motion planning, C-space of a single, rigid object, obstacles in C-space. Artificial potential fields. Grasp and task-level planning. Trajectory planning. Position and force control. Robot Control: Lagranian and Hamiltonian formulation. Feedback linearization Design via Lyapunov's second method. Singular perturbations and integral manifolds. Robustness of adaptive control.

EC 578	Soft Computing & Applications	3 Credits

Pre-requisites: EC 451

The course provides the comprehensive treatment of the constituent methodologies underlying soft computing, an evolving branch within the scope of computational intelligence that is drawing increasingly more attention as it develops. Its main features include fuzzy set theory, fuzzy systems, neural networks, genetic algorithms, hybrid systems, and fuzzy clustering which is aimed at solving real world problems such as decision-making, modeling, recognition, classification, and control problems. In particular, course put equal emphases on theoretical aspects of covered methodologies, as well as empirical observations and verifications of various applications in practice.

EC 579	Computer Systems Performance Evaluation	3 Credits

Pre-requisites: EC 451 + EC 482

The course introduces the main concepts and techniques needed to plan the capacity of computer systems, predict their future performance under different configurations, and design new applications that meet performance requirements. The techniques are applied to study the performance of centralized, distributed, parallel, client/server systems. The course provides the students with hands-on experience in performance evaluation through a project. The concept and applications of software performance engineering are also covered.

EC 580	Special Topics in Digital Systems	3 Credits

Pre-requisites: EC 451 + EC 482

Computer Architecture: Design methodology. CPU and ALU design. Hardware and micro programmed control. Interrupt and DMA I/O processors. VLSI, VHDL. Logic

Circuit Synthesis and Optimization: Advanced design of logic circuits. Multilevel optimization of combinational circuits. Optimization of finite-state machines. Computer- aided design algorithms.

EC 582	FPGA Design for Embedded Systems	3 Credits

Pre-requisites: EC 482

With the advance of semiconductor technology, the complexity of digital circuits has increased to a level that circuit designers cannot handle without the help of modern sophisticated Electronic Design Automation (EDA) tools. This course covers the use of Verilog HDL in high-level synthesis of digital system designs. The language Verilog HDL as well as how it is used for describing, modeling, simulating and synthesizing various digital modules. Verilog HDL coding and synthesis issues on combinational and sequential modules including Finite State Machine will be discussed. In the hands-on sessions, students will synthesize and test the designs with industrial so□ware packages (ModelSim / Quartus II) and FPGA devices. The course comprises lecture sessions on Verilog HDL language, hands-on sessions on coding, synthesis and simulation. The course study will also involve extensive lab experiments to give students hands-on experience on designing digital systems on FPGA platforms and going through a complete cycle of design.

EC 583	VLSI Systems	3 Credits

Pre-requisites: EC 483

VHDL: Modeling systems behavior in VHDL. Automated/ manual synthesis. Testing and design for testability.

Top-down VLSI design methodology. CAD tools in the VLSI CMOS circuit and subsystem design. Design tools. Simulation and verification methods. Advanced VLSI Circuits: Architecture and circuit level design and analysis of integrated A/D and D/A interfaces in CMOS and BICMOS VLSI technology. CAD tools for analog design including simulation and synthesis.

EC 584	Design of Fault-Tolerant Digital Systems	3 Credits

Pre-requisites: EC 414

Fault-tolerant computing, demonstration of error detection and recovery. Hardware and software models. Fault –tolerant techniques, coding, check pointing recovery. Reliable networked systems. Security. Case studies of reliable system design.

EC 585	Computer Architecture	3 Credits

Pre-requisites: EC 483 and EC451

This course deals with the design and performance evaluation of advanced/high performance computer systems. The emphasis is on microprocessors, chip-multiprocessors and memory hierarchy design. Historical information is presented as well as along with data storage and low-power dissipation schemes. Special attention is paid to pipelining, ILP (instruction-level parallelism), DLP (data-level parallelism) and TLP (thread-level parallelism) using hardware and software techniques to yield high performance.

EC 586	Computer Graphics	3 Credits

Pre-requisites: EC 372 and EC 352

Computer graphics fundamentals and applications. Computer graphics application: survey. Graphic I/O devices and systems. Graphics output primitives. Two-dimensional transformation. Intro, to interactive graphics: user interface and graphics modeling techniques.

Intro, to three-dimensional graphics transformation: hidden lines, hidden surfaces problems.

Famous graphics packages and CAD software.

EC 587	Digital Systems Testing & Simulation	3 Credits

Pre-requisites: EC 482

Modeling, Logic simulation, Event driven simulator. Automatic test patter generation. Path systemization, D-algorithm, PODEM, FAN. Fault simulation: Serial, parallel, detective and concurrent. Design for testability: Scan path, LSSD, Signature analysis, and Functional testing.

EC 588	Switching Theory	3 Credits

Pre-requisites: EC 482

Finite state automata. Functional decomposition. Threshold logic. Multistage logic. Synchronous and asynchronous sequential design. Sequential circuit decomposition. Fault detection and diagnosis in combinational and sequential machines.

EC 589	Computer Aided Design	3 Credits

Pre-requisites: EC 313 + EC 372

Software system for computer-aided design of the electronic circuits - an overview. Computer programs for electronic circuit analysis. Models of the circuit elements: diode, bipolar and transistor. Nodal and modified nodal methods - the realization in computer programs. AC and sensitivity analysis. Mathematical methods in computer analysis of the electronic circuits.

EC 590	Computer & Society	3 Credits

Pre-requisites: EC 451 + EC 482

The course is an introductory examination of the effects of computer technology on contemporary society. Topics include productivity applications, creation of Web pages, and societal and ethical issues in computing; privacy, security, censorship, and the changes in work, school, and entertainment fostered by computing. The course is seminar based. Students taking the course will be divided into groups. Topics or mini projects will be assigned to each group, and students will be expected to engage with others in group work activities.

EC 591	Parallel Processing	3 Credits

Pre-requisites: EC 301 + EC 585

Parallel architecture, dynamic interconnection networks, static interconnection networks, hypercube architecture, routing mechanisms, communication costs, cost-performance trade-offs, communication operations, performance of parallel

systems,
parallel algorithms, matrix algorithms, sorting, search algorithms, graph algorithms.

EC 593	Digital Image Processing	3 Credits

Pre-requisites: EC 301

Image enhancement, restoration, and color image processing. Digital image generation, adjacency, connectivity, regions and boundaries, Frequency domain analysis, Image enhancement techniques in spatial and frequency domains, Image restoration in spatial and frequency domain (in presence of noise and other degradations), Color image processing, Image lossless and lossy compression.