

Computer Engineering

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- 204101 Basic Concepts and Applications of Computers** 1 (1-0)
Basic computer concepts; computer components and organization; flowcharts and structured programming; computer applications; the impact of computers on society.
- 204111 Computers and Programming** 3 (2-3)
Basic structure of modern computer systems; data representation in computers; algorithmic problem solving; program design and development methodology; introductory programming using a high-level programming language; programming practice in computer laboratory.
- 204112 Information Technology for Engineers** 1 (0-2)
Self - learning from electronic sources concerning computer architecture, data storage in computer system, computer software classification, computer software installation and usage, office software usage, computer network, internet surfing, information and database management system, basic computer maintenance, and applications of computer in engineering fields.
- 204211 Discrete Mathematics** 3 (3-0)
Sets, sequences, and functions; logic; the growth of functions; methods of proof and mathematical induction; recursive definitions and algorithms; counting methods and recurrence relations; relations; introduction to graph theory.
- 204212 Abstract Data Types and Problem Solving** 3 (3-0)
Abstract data types; data abstraction; basic algorithms for problem solving; application of abstract data types; heuristic techniques; analysis of algorithm complexity.
- 204213 Theory of Computation** 3 (3-0)
Prerequisite : 204211
Deterministic and non-deterministic finite automata; regular languages and regular grammars; pushdown automata and context-free grammars; Turing machines and computability; the Chomsky hierarchy; uncomputability and undecidable problems.

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- 204214 Programming Skill Development Laboratory** 1 (0-3)
 Programming skill development; practice the use of practical programming languages and their integrated environments.
- 204221 Computer Organization and Assembly Language** 3 (3-0)
 Basic computer organization; registers, arithmetic-logic unit, and control unit; machine representation of data and instructions; machine language and assembly language programming; addressing modes; interrupts and input/output programming.
- 204222 Digital Systems Design** 3 (3-0)
 Basic digital systems; boolean algebra; digital design techniques; logic gates; logic minimization; standard combinational circuits, sequential circuits; flip-flops; synchronous and asynchronous sequential circuits; PLA, ROM, and RAM; arithmetic circuits; computer-aided logic design.
- 204223 Practicum for Computer Engineering** 1 (0-3)
 Software practice in the use of a modern operating system programming environment and the use of program development and networking tools; hardware practice in electronic circuits assembly and basic network cabling and installation; small project assignments.
- 204224 Logic Circuit Laboratory** 1 (0-3)
 Laboratory works related to the topics in 204222.
- 204312 Probability and Random Processes for Computer Engineers** 3 (3-0)
Prerequisite : 417168
 Probability; conditional probability and independence of events; random variables; distribution and density functions; functions of one random variable; multiple random variables; operations on one and multiple random variables; laws of large numbers; central limit theorem; random processes and their applications; application to computer engineering problems.
- 204313 Algorithm Design and Analysis** 3 (3-0)
Prerequisite : 204211 and 204212
 Design and analysis of algorithms, correctness of algorithms, complexity analysis, divide-and-conquer techniques, selection, searching, dynamic programming, combinatorial problems, graph problems, NP-complete problems, parallel algorithms.

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- 204321 **Computer Architecture** 3 (3-0)
 Prerequisite : 204221 and 204222
 Basic concepts of computer architecture and organization; computer evolution; design methodology; performance evaluation; CPU architecture; instruction sets; ALU design; hardwired and microprogrammed control; memory hierarchies; virtual memory; cache memory; input/output architectures; interrupts and DMA; parallel processing; pipelined processors; multiprocessors.
- 204323 **Microprocessors and Microcomputer Design** 3 (3-0)
 Prerequisite : 204321
 Technology and architecture of microprocessors; characteristics and classification of microprocessors; microprocessor interfacing techniques; standard and high-speed buses; design of memory, input/output, and peripheral devices; design of microcomputers.
- 204324 **Computer System Laboratory** 1 (0-3)
 Prerequisite : 204224 and 204321
 Laboratory works related to the topics in 204224 and 204321.
- 204325 **Data Communication and Computer Networks** 3 (3-0)
 Data communication networks and open system standards; data transmission; data link controls; technologies of local area networks and wide area networks; communication architecture and protocols.
- 204331 **System Software** 3 (3-0)
 Prerequisite : 204212 and 204221
 Basic principles of programming systems; relationship between system software and machine architecture; principles and design of assemblers, loaders, linkers, and macroprocessors; introduction to programming language processors.
- 204332 **Operating Systems** 3(3-0)
 Prerequisite : 204331
 Basic concepts of operating systems; processes and concurrency; process management and scheduling; input/output management; memory management; file systems; computer systems security.

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- 204341 Design and Construction of Large Software Systems** 3 (3-0)
Prerequisite : 204313
 Software design concepts; object-oriented analysis and design techniques; unified modeling language; software architecture; design patterns; software components and design; software construction techniques; software testing techniques.
- 204342 Managing Software Development** 3 (3-0)
Prerequisite : 204341
 Software process concepts; software process improvement and quality models; software process models; requirement management and elicitation; software project management; software quality assurance; inspection techniques; software configuration management.
- 204351 Database Systems** 3 (3-0)
Prerequisite : 204212
 General characteristics of information systems; data storage techniques; data manipulation and searching services; file management; information retrieval techniques; principles of database systems and database management; database modeling; hierarchical model, network model, relational model, and object-oriented model; applications of database systems.
- 204352 Laws and Ethics in Information Technology** 3 (3-0)
 Laws and ethical issues related to computer engineering and information technology; trading and commerce issues; computer abuse; social justice issues; free speech; privacy; risk in computer systems; intellectual properties.
- 204371 Transform Techniques in Signal Analysis** 3 (3-0)
Prerequisite : 417267
 Analysis techniques of continuous and discrete signals of linear system in time domain; Fourier series; Fourier transform, Laplace transform, and Z-transform; sampling theory; solving differential equations and difference equations using transform techniques with applications.
- 204411 Symbolic Computation** 3 (3-0)
Prerequisite : 204213
 Symbolic logic; syntax and semantic analyses of terms and sentences; reasoning and theorem proving; symbolic computation with functional programming and logic programming.

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204421	Computer Networks Prerequisite : 204325 TCP/IP protocol suite; routing protocols; internetworking with TCP/IP; network management; network security.	3 (3-0)
204422	Computer Communication and Network Laboratory Prerequisite : 204325 Laboratory experiments on topics covered in 204325.	1 (0-3)
204424	Digital Design Automation Prerequisite : 204222 Basics of digital design automation; techniques and tools for digital design automation; hardware descriptive language; hardware compiler; computer architecture testing and simulating; logic circuit simulation; automation programs; partitioning; component placing and routing of digital circuits.	3 (3-0)
204425	Network Programming Prerequisite : 204325 TCP/IP; client-server model; interprocess communications; socket interface; TCP and UDP sockets; daemon process; raw sockets; algorithm for client and server.	3 (3-0)
204426	Network Configuration Prerequisite : 204325 Open system interconnection model; local area network; local area network design and documentation; TCP/IP and IP addressing; wide area network; router components and configuration; routing protocol; network troubleshooting; virtual local area network; network management; wide area network design.	3 (2-3)
204432	Object-Oriented Computing Prerequisite : 204313 Object-oriented software development for enterprise information system; distributed object technology; common object request broker architecture (CORBA) and its applications.	3 (3-0)
204433	Programming Language Translation Prerequisite : 204213 and 204331 Organization of programming languages; introduction to programming language translation and translators; lexical, syntax, and semantic analysis; symbol-table manipulation; code generation and code optimization; compile-time error handling.	3 (3-0)

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- 204434 Parallel and Distributed Computing Systems 3 (3-0)**
Prerequisite : 204313
 Computer architecture for parallel processing, pipelining and distributed processing; parallel algorithms; design of parallel and distributed computing systems; file transfer methods; monitoring management; network topologies and distributed operating systems.
- 204435 Programming Language Concepts 3 (3-0)**
Prerequisite : 204213 and 204331
 Structure and organization of programming languages; language processors; syntax; data types; sequence control; subprogram control; storage management; implementation techniques of each language feature; the study and comparison of major programming paradigms.
- 204451 Database Systems Design 3 (3-0)**
Prerequisite : 204351
 Data models; hierarchical databases, network databases, and relational databases; structures of logical databases; entities and relations; normalization; data definition languages and data manipulation languages; data security, backup, consistency, reliability, and integrity; distributed databases.
- 204452 Information Technology Management 3 (3-0)**
 Organizing information technology (IT) departments; planning information systems; managing IT resources; project management for the design, development, implementation, installation, and evaluation of an information system; cost/benefit analysis for information systems; impacts of IT on organizations, individuals, and societies; ethics, laws, and national policies concerning IT.
- 204461 Artificial Intelligence 3 (3-0)**
Prerequisite : 204213 and 204313
 Introduction to artificial intelligence: its scope, history and techniques; knowledge representation; memory structures; reasoning mechanisms; probabilistic reasoning and searching techniques; games; planning; machine learning; natural language processing; computer vision; expert systems.

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204462	<p>Introduction to Expert Systems</p> <p>Prerequisite : 204461</p> <p>Knowledge representation techniques: frames, rules, and semantic networks; searching knowledge base; reasoning mechanisms with forward chaining and backward chaining; expert system case studies; design and development of expert systems: knowledge acquisition, validation and verification, user interface and natural language understanding.</p>	3 (3-0)
204463	<p>Introduction to Natural Language Processing</p> <p>Prerequisite : 204213</p> <p>Introduction to basic computation of natural language processing; syntax analysis of structure of sentences; semantics of sentences; analysis and relation creation between sentences.</p>	3 (3-0)
204464	<p>Computer Vision</p> <p>Prerequisite : 204461</p> <p>Study of automatic and semi-automatic of vision management; pattern selection; groups processing; hierarchical structures; graphical procedures for structure description; 3-dimensional object representation methods.</p>	3 (3-0)
204471	<p>Microcomputer Interfacing</p> <p>Prerequisite : 204323</p> <p>Switching devices and applications; sensors; signal conversion; automatic control systems; microcomputer interfacing techniques; microcontrollers and interfacing; robotics.</p>	3 (3-0)
204472	<p>Numerical Computation</p> <p>Prerequisite : 204212 and 417267</p> <p>Number systems; algorithms for number crunching; solving engineering problems with computers: estimation, differentiation, numerical integration, differential equations, linear and non-linear system equations, curve fitting, and fast Fourier transform.</p>	3 (3-0)
204481	<p>Foundations of Computer Graphics</p> <p>Prerequisite : 204313</p> <p>Hardware for the display of graphics generation; data structures for graphical display, 2- and 3-dimensional transformations; matrix transformation techniques in 3-dimensional viewport; clipping; window user interface.</p>	3 (3-0)

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- 204482 **Computer-Human Interfaces** 3 (3-0)
Prerequisite : 204313
Design and construction of human-computer interfaces; hardware and software architecture for personal workstations; object-oriented programming; interactive display management and windows.
- 204495 **Computer Engineering Project Preparation** 2 (2-0)
Design and management of engineering projects; technical report writing; literature review and reference; technical report presentation; preparation for a computer engineering project proposal; presentation of the project proposal.
- 204496 **Selected Topics in Computer Engineering** 1-3
Selected topics in computer engineering at the bachelor degree level. Topics are subject to change in each semester.
- 204497 **Seminar** 1
Presentation and discussion of interesting topics in computer engineering at the bachelor degree level.
- 204498 **Special Problems** 1-3
Study and research in computer engineering at the bachelor degree level and compiled into a report.
- 204499 **Computer Engineering Project** 2 (0-6)
Prerequisite : 204495
Project of practical interest in various fields of computer engineering.