



NAME Mr. Kittipat Apicharttrisorn
 IDENTIFICATION NO. 4 1101 00025 18 0
 NATIONALITY Thai
 ADMISSION May 28, 2007 (B.E. 2550)
 PREVIOUS DEGREE B.Eng. / Oct 2, 2004
 FACULTY Engineering
 DEPT / PROGRAM Computer Engineering
 FIELD OF STUDY Computer Science
 DEGREE Master of Science

CHULALONGKORN
UNIVERSITY
 BANGKOK 10330
 THAILAND

COURSE NO.	ABBREVIATED NAME	CREDIT	GRADE	COURSE NO.	ABBREVIATED NAME	CREDIT	GRADE	COURSE NO.	ABBREVIATED NAME	CREDIT	GRADE
1ST SEMESTER 2007											
2110606	RES METH COMP ENG	3	S								
2110671	DATABASE MGT SYS	3	B+								
2110684	INF SYS ARCH	3	A								
2110711	THEORY COMPUTATION	3	B+								
9 12	3.67	9 12	3.67		33.00						
2ND SEMESTER 2007											
2110681	COMPUTER ALGORITHM	3	B+								
2110701	SEMINAR COM ENG I	1	S								
2110795	ADV TOPIC NETWORK	3	A								
6 7	3.75	15 19	3.70		55.50						
1ST SEMESTER 2008											
2110654	ARTIFCL INTELL	3	A								
2110731	DISTRIBUT SYS	3	A								
2110811	THESIS	3	P								
6 6	4.00	21 25	3.79		79.50						
2ND SEMESTER 2008											
2110682	EMB/REAL-TIME SYS	3	B+								
2110811	THESIS	9	P								
3 3	3.50	24 28	3.75		90.00						
1ST SEMESTER 2009											
2110639	COMP SYS SECURITY	3	V								
2110811	THESIS	0	P								
0 0	0.00	24 28	3.75		90.00						
2ND SEMESTER 2009											
2110781	SPEC TOP DIST SYS	3	V								
2110811	THESIS	0	P								
0 0	0.00	24 28	3.75		90.00						
1ST SEMESTER 2010											
2110811	THESIS	0	P								
0 0	0.00	24 28	3.75		90.00						
CA CG GPA CAX CGX GPAX		GPX									
Total credits registered	=	46									
Total credits earned	=	40									
cumulative grade point average =	3.75										
***** J.O											
				2110811 THESIS GOOD TITLE : DISTRIBUTED TIME SYNCHRONIZATION FOR WIRELESS SENSOR NETWORKS							

A = 4.00	I = INCOMPLETE	CA = CREDIT ATTEMPTED
B+ = 3.50	M = MISSING	CG = CREDIT GRANTED
B = 3.00	P = IN PROGRESS	GPA = GRADE POINT AVERAGE
C+ = 2.50	S = SATISFACTORY	CAX = CUMULATIVE CA
C = 2.00	U = UNSATISFACTORY	CGX = CUMULATIVE CG
D+ = 1.50	V = VISITOR	GPAX = CUMULATIVE GPA
D = 1.00	W = WITHDRAWN	GPX = CUMULATIVE GRADE POINT
F = 0.00	X = NO REPORT	

GRADUATION : GPAX OF 3.00 IS REQUIRED
THESIS : VERY GOOD, GOOD, PASS, FAILURE

CERTIFIED TRUE COPY
 REGISTRAR
 NOT VALID WITHOUT UNIVERSITY SEAL

(Assoc. Prof. Vallapa Prakobphol)

DATE Nov 26, 2010 (B.E. 2553)



**OFFICE OF THE REGISTRAR
CHULALONGKORN UNIVERSITY**

Bangkok 10330, Thailand

No. 65449/2553

THIS IS TO CERTIFY THAT

Mr. Kittipat Apicharttrisorn

Student ID 507 14040 21 Identification No. 4 1101 00025 18 0

has completed all the requirement for the Master of Science Degree

field of study Computer Science.

The University Council admitted the Master of Science Degree on November 08, 2010.

Given on November 26, 2010

Vallapa Prakobphol

(Assoc. Prof. Vallapa Prakobphol)

Registrar

NOT VALID WITHOUT UNIVERSITY SEAL

2110541	Computer Systems Audit	3(3-0-9)	
	Design of information system; internal control and auditing of data; validity; reliability; security and protection.		
2110605	Computer Programs Structure	3(3-0-9)	
	High-level structured programming languages; data types and operations; control structures; subprograms; records, sets, pointers and dynamic memory allocations; recursive programming; non-numerical problem solving techniques; problem analysis and program design; introduction to software engineering.		
2110606	Research Methods in Computer Engineering	3(3-0-9)	
	Research methods in Computer Engineering; Research techniques and tools; Project and time management; Technical paper writing; Oral presentation; Current research topics.		
2110611	Information Processing and Computer System	3(3-0-9)	
	Introduction to information processing concepts, processing methods, computer development and applications; classification and architecture; data communications and computer networks; computer center management.		
2110612	System Programming	3(3-0-9)	
	Components of a programming system; evolution of operating systems; design of assembler, macro language, macro processor, loader schemes; types of loaders; design of loaders.		
2110614	Programming Languages and Compilation	3(3-0-9)	
	Language structures data, operation, control structures; software-simulated computer; language translation lexical analysis, and parsing, and code generation; other language methodologies list processing, logic programming, object-oriented programming.		
2110615	System Analysis and Design	3(3-0-9)	
	Basic analysis steps, determining system alternatives, determining system economics, defining logical system requirements, basic design tools and objectives; hardware and software: selection and evaluation; design and engineering of software; database development, program development, system implementation, post implementation analysis.		
2110622	Data Management	3(3-0-9)	
	List structures: lists, stacks, queues; table and hash in tree structures: binary search trees, AVL trees, B-trees, heaps; searching and sorting; fundamental of file structures		
2110623	Software Requirements Engineering	3(3-0-9)	
	Methods, tools, notations, and validation techniques for the elicitation, analysis and specification of software requirements; investigating the project or applying approaches to software requirements engineering.		
2110624	Software Engineering	3(3-0-9)	
	Fundamental areas of software engineering: life cycle, paradigms, metrics, and tools; management techniques; cost estimation; software maintenance methodologies; incremental programming; very high level languages.		
2110629	File Management	3(3-0-9)	
	Introduction to data management, files, and applications; an overview of input/output system architecture; logical file organizations; mapping logical organization onto physical storage; operating systems; file system interface; higher level languages; data management facilities.		
2110631	Operating System	3(3-0-9)	
	Evolution, types, goals, functions and organization: concepts of process; process synchronization; process management; memory management; device management; file management;		
2110632	Advanced Topics in Operating Systems	3(3-0-9)	
	<i>Condition: Consent of Faculty</i> Advanced and current topics in Operating Systems.		
2110634	Software Design and Development	3(3-0-9)	
	Techniques of software design and development: project management, structured programming, verification and validation, security and privacy, and project documentation; students are required to apply these techniques to large software projects.		
2110636	Performance Analysis and Evaluation	3(3-0-9)	
	Statistical techniques of computer system performance evaluation and measurement; system selection and tuning strategies; deterministic and probabilistic models of process scheduling and resource allocation; analytic and simulation models of computer system; systematic study of system architectures.		
2110638	Object-Oriented Technology	3(3-0-9)	
	<i>Condition: Consent of Faculty</i> Classes, methods, messages, instances, inheritance, binding: static, dynamic, replacement, refinement, polymorphism, frameworks, design patterns, object-oriented software engineering: software design and construction, application of object-oriented technology: object-oriented databases, distributed objects, current topics in object-oriented technology		
2110639	Computer System Security	3(3-0-9)	
	Security system planning and administration; access control; data encryption; computer crime protection; disaster recovery planning; security models; including Orange book, and RACF		
2110642	Object-Oriented Software Engineering	3(3-0-9)	
	An overview of object-oriented technology concepts on objects, classes, inheritance, polymorphism, and relationship between classes; software development process, software configuration management, software quality assurance, object-oriented project planning and management, object-oriented analysis and design methodologies, object-oriented programming and object-oriented software testing and maintenance, use of CASE tools.		



2110644 Formal Software Specification 3(3-0-9)
Mathematical Logic: Set, Relation, Function, Predicate Calculus, Algebraic system; Formal software specification language: Z, CafeOBJ; Identifying problem domain; Design and software modeling; Formal software specification method; Consistency verification of formal specification and its proof; Utilization of formal software specification in software process.

2110645 Software Engineering Methodology 3(3-0-9)

Software engineering process concepts; context for personal software process; planning and measurement concepts; software size measurement; general size estimating methods; resource and schedule estimation; process measurement; design and code reviews; software quality management.

2110646 User Interface Design 3(3-0-9)

Foundations of user-interface; human-centered software evaluation; software development; graphic user-interface design; graphic user-interface programming; multimedia systems.

2110651 Digital Image Processing 3(3-0-9)

Visual perception, digitization and coding of images, converting pictures to discrete(digital) forms; image enhancement; image restoration including improving degraded low-contrast, blurred, or noisy pictures; image compression : data compression used in image processing; image segmentation referred to as first step in image analysis.

2110654 Artificial Intelligence 3(3-0-9)

Definitions and application of artificial intelligence; knowledge representation; Prolog programming; natural language processing; machine learning techniques.

2110657 Computer Simulation 3(3-0-9)

Monte Carlo simulation; discrete event simulation and implementation techniques, queueing theory; equilibrium and steady state; input/output analysis; random numbers; output measurement; simulation accuracy; trace and execution-driven simulation; computer system simulation; continuous system simulation; combining continuous and discrete-event simulation

2110661 Computer Network 3(3-0-9)

Introduction to network and network components; transmission links and protocols; design and analysis of networks; WAN; IMP; topology; network protocols; flow control and routing techniques.

2110662 Communication and Computer Network 3(3-0-9)

Network components; transmission links and protocols; design and analysis of networks; WAN; IMP; topology; network protocols; flow control and routing techniques.

2110664 Network Management 3(3-0-9)
Condition: Consent of Faculty

Information systems environment, business, and networks; network management data integrity, data security, network availability, network service, network adaptability.

2110665 Computer Communication System and Standards 3(3-0-9)

Introduction to computer and communication systems: on-line system, computer networks, distributed processing; communication model: OSI Standard; networks and standards: ISDN, X.25.

2110671 Database Management Systems 3(3-0-9)

Definition, objectives, and basic concepts information storage and retrieval system; data management system; data management functions and components of database management system: database interrogation, update; data model; security policy; major trade-offs in database management; introduction to object oriented database.

2110672 Data Modeling Techniques 3(3-0-9)

Data modelling concepts; conceptual objects used on simple and complex abstraction level: entity and entity set, entity attributes, relationship and relationship sets, relationship attributes, domain; normalization of relation: INF, 2NF, 3NF, 4NF and 5NF; conceptual data modeling: entity-relationship, data flow, logical and physical model, transformation of theoretical mode into a physical model, and functional design; object-oriented design concept.

2110673 Information Storage and Retrieval 3(3-0-9)

Models and methods for storage and retrieval of information; Topics include information retrieval techniques, text analysis and automatic indexing, document clustering, search techniques, retrieval performance measurement, and search mechanisms for retrieval from the World Wide Web.

2110674 Information Technology Center Management 3(3-0-9)

Organization of the Information-Technology Center, computer personnel; nature of the users; software development tools; computer site operation; personnel management; systems software tuning; hardware evaluation; problems facing the director of the center.

2110678 Mobile Computing 3(3-0-9)
Condition: Consent of Faculty

Principle of mobile radio communication, principle access communication, teletraffic theory, wireless networking, present and next generation mobile and cordless telecommunication systems.

2110681 Computer Algorithm 3(3-0-9)

Analysis and design of efficient algorithms; divide and conquer, recursion, dynamic programming and greedy algorithm; selection of appropriate data abstraction; analysis and correctness of algorithms; algebraic algorithms; combination problems; proving techniques for complexity analysis.

2110682 Embedded and Real-time Systems 3(3-0-9)

Microcontroller architecture (RAM, ROM, CPU), I/O, and peripheral devices, I/O interfacing, real-time operating systems, real-time constraints, scheduling theory, real-time system design methodology, case studies.



2110683	Concurrent Processing	3(3-0-9)	
	Principles of distributed, parallel and concurrent systems; parallel architecture and concurrent computing models; concepts of networks protocols for concurrent processing, operating systems and hardware support for distribution of codes, concurrent processing, parallel processing and networking.		
2110684	Information System Architecture	3(3-0-9)	
	Hardware systems: personal computers, network equipment, servers, clusters and super servers, embedded system; application systems: multi-tier systems, markup language, query language; transaction systems: process abstraction, inter-process communication, synchronization, deadlock, transactions, concurrency control; Web-based applications; global systems.		
2110685	Computer Application in Enterprises	3(3-0-9)	
	Business transaction; processes and organisation; information and business decision; human resources and knowledge management; data warehousing.		
2110686	Enterprise Computing	3(3-0-9)	
	IT infrastructure; management; stability, efficiency and responsiveness; theoretical and practical aspects of systems management; discipline in data centres; development, integration, and management of IT processes; business-support functions; enterprise services; information systems services.		
2110694	Directed Studies in Computer Science	3(3-0-9)	
	Study of current interest and new developments in various fields of computer science.		
2110696	Advanced Topics in Computer Application	3(3-0-9)	
	Current advanced topics and technologies in computer applications.		
2110697	Special Topics in Computer Science I	3(3-0-9)	
	Current special topics and new technologies in computer science.		
2110698	Special Topics in Computer Science II	3(3-0-9)	
	Current special topics and new technologies in computer science.		
2110701	Seminar in Computer Engineering I	1(0-3-1)	
	Seminar in Computer Engineering about the thesis and assignments		
2110702	Seminar in Computer Engineering II	1(0-3-1)	
	Seminar in Computer Engineering about the thesis and assignments.		
2110711	Theory of Computation	3(3-0-9)	
	Computable functions decidable predicates and solvable problems; computational complexity; NP-complete problems; automata theory; formal language; lambda calculus.		
2110712	Analysis of Algorithms	3(3-0-9)	
	Algorithm complexity and problem complexity; discrete mathematics real analysis, and combinatorics; algorithms and data structures; average-case worst-case and amortized analysis.		
2110713	Optimization Methods	3(3-0-9)	
	Dynamic optimization; mathematical programming; least square methods; gradient methods; Newton's method; linear programming; nonlinear programming; discrete optimizations.		
2110714	Digital Systems	3(3-0-9)	
	Digital system architecture; logic elements, processor, compilers, operating systems; digital abstraction, synthesis of digital systems; performance measures; interpretation; micro architecture; memory architecture; processes; multiplexing; synchronization; interrupts; real time systems.		
2110716	Seminar i	1(1-0-3)	
	Seminar in the assigned topics on current experiment and / or research on computer engineering.		
2110717	Seminar II	1(1-0-3)	
	Seminar on current experiment and / or research on computer engineering concerning theses.		
2110718	Seminar III	1(1-0-3)	
	Seminar on current experiment and / or research on computer engineering concerning theses.		
2110719	Seminar IV	1(1-0-3)	
	Seminar on current experiment and / or research on computer engineering concerning theses.		
2110721	Software Metrics	3(3-0-9)	
	Theoretical foundations of software metrics; data collection; experimental design and analysis; software metric validation; measuring the software development and maintenance process; measuring software systems; support for metrics; statistical tools; applications of software measurement.		
2110722	Software Project Management	3(3-0-9)	
	Concepts of software product and process quality; roles of Total Quality Management (TQM); use of metrics, feasibility studies; cost and effort estimates; discussion of project planning and scheduling; the Capability Maturity Model; basic tenets and application of process validation.		
2110723	Advanced Software Engineering Development	3(3-0-9)	
	Software development process improvement; a series of individual programming and process projects; project planning measurement size estimation task scheduling and defect clarification.		
2110724	Software Testing and Quality Assurance	3(3-0-9)	
	Technical and management views of software testing and SQA; quality concepts; black and white box testing techniques; test coverage; levels of testing; the formation of a testing organization; testing-in-the-large; documentation for testing; inspections and walkthroughs.		



2110791	Advanced Topics in Software Engineering	2(3-0-9)
State of the art and current interest in software engineering.		
2110792	Advanced Topics in Artificial Intelligence	3(3-0-9)
In-depth study of the current and interesting topics in artificial intelligence : problem solving, search, heuristic methods, machine learning, knowledge representation, natural language processing, computer vision, expert systems, theorem proving and current applications.		
2110793	Advanced Topics in Digital Systems	3(3-0-9)
State of the art and current interest in digital systems.		
2110794	Advanced Topics in Database Systems	3(3-0-9)
State of the art and current interest in database systems.		
2110795	Advanced Topics in Computer Network	3(3-0-9)
State of the art and current interest in computer network.		
2110797	Per-Master Project in Software Engineering	3(0-0-12)
<i>Condition : Consent of Faculty</i> Integration of software engineering principles to prepare for software engineering project to get the output which in the project proposal.		
2110798	Per-Master Project in Software Engineering	3(0-0-12)
<i>Condition : Prerequisite 2110797</i> Integration of software engineering principles for software engineering project.		
2110799	Master Project	6(0-0-24)
2110811	Thesis	12 Credits
2110814	Thesis	24 Credits
2110816	Thesis	36 Credits
2110828	Dissertation	48 Credits
2110894	Doctoral Dissertation Seminar	0(0-0-0)
2110896	Comprehensive Examination	0(0-0-0)
2110897	Qualifying Examination	0(0-0-0)

**COURSES OFFERED TO STUDENTS OUTSIDE
FACULTY OF ENGINEERING ONLY :**

2110102 Computer Programming - Fortran

Computer systems, problem-solving procedures, algorithms, control structures, data types, vector, array and record, string manipulation. Coding, compiling and linking Fortran programs, constants and variables, operators and expressions, assignment statements, control statements, functions and subprograms, numeric and character applications.

2110103 Computer Programming-Pascal

Computer systems, problem-solving procedures, algorithms, control structures, data types, vector, array and record, string manipulation. Pascal data types, variables, operators, expression, assignment statement, identifiers, program structure, input, output and control statements, procedures and functions composited data types, files.

2110104 Computer Programming - C

Computer system, problem-solving procedures, algorithms, control structures, data types, vector, array and record, string manipulation. C programming concepts, constants, variables, operators and expressions, statements, functions, array and pointer, structure, preprocessor.

2110172 Information Technology 3(2-2-5)

Application software packages: word processing, spreadsheet, presentation and database software; utility software; basic computer system management: backup and restore, software installation and uninstallation.

2110182 Introduction to computer and data Processing 2(2-0-4)

An overview of computer components, hardware and software interaction: basic data processing concepts, data transformation, method of data processing, data communication and programming concepts.

2110183 Introduction to Computer and Programming 3(3-0-6)

An overview of computer components, hardware and software interaction, EDP concepts: programming concepts and introduction to FORTRAN programming.

2110206 Assembly Language Programming 3(2-2-4)

This course will emphasized hand-on experience with Assembly language programming, loader, assembler and I/O devices.

2110281 Basic Programming 2(1-2-3)

Overview of elements of Basic Language, including BASIC statements: arithmetic, input and output; flow of control, subprogram; file processing; sequential access, and random access, application programs in various fields.



2110728	Special Topics in Software Engineering I <i>Condition : Consent of Faculty</i>	3(3-0-9)	2110745	Cryptography Introduction; symmetric encryption; block ciphers; pseudorandom permutations and pseudorandom functions; one-way functions; pseudorandom generators; hash functions; message authentication; authenticated encryption; asymmetric encryption; digital signatures; authenticated key exchange; interactive proofs and zero knowledge.	3(3-0-9)
2110729	Special Topics in Software Engineering II <i>Condition : Consent of Faculty</i>	3(3-0-9)	2110751	Computer Aided Design in Digital Systems Layout editing; schematic datacapture; simulation; design rule checking; automatic placement and routing; logic synthesis for combination and sequential circuits; logic synthesis for architectural design; formal method for specifications.	3(3-0-9)
2110730	Software Quality and Process Management Software quality basics; quality tools; software life cycle processes and process assets establishment; process management premise; process improvement models; improvement paradigms; quality management in process improvement context; configuration management; measurement information model.	3(3-0-9)	2110752	Design for Testability Methods of design for testability; digital chip design for automatic testing equipment; ad hoc rules and structured method called scan design; fault analysis; controllability; observability; Scan-In Scan-Out (SISO) principle; Level Sensitive Scan Design (LSSD); built-in testing and other current techniques.	3(3-0-9)
2110731	Distributed Systems Definition; interprocess communication; logical clock; concurrency control; locking: two-phase, optimistic, timestamp ordering; distributed transaction, atomic commit protocol; deadlock; detection, prevention, avoidance, distributed selection; scheduling reliability; fault tolerance, replication, recovery, security, distributed services; name, file; distributed management; standards and cases: SNMP, CORBA, DCOM, ANSA.	3(3-0-9)	2110753	Asynchronous Design Design of digital systems not using global clock; limitation to synchronous processor; hazard analysis; Fundamental of asynchronous logic design; delay assumption; signaling protocol; asynchronous communication; Petri net; signal transition graph; completion detection; data and control paths implementations.	3(3-0-9)
2110732	Parallel Computing Architectures in parallel computing : shared/distributed memory, SIMD/MIMD architecture, interconnection networks, granularity of the machines, dataflow and systolic arrays computers; parallel processing : pipelining and parallelism, software for parallel computers.	3(3-0-9)	2110771	Advanced Database Design Fundamental of database design : data modeling, relational theory, query language, dependency theory; query optimization, computing with logic and universal relation.	3(3-0-9)
2110741	Robotics A broad view of robotics : robot control, sensors and interfacing, robot intelligence and programming; a broad spectrum of disciplines : mechanical, electrical, industrial, and computer engineering; current topics : planning, subsumption architecture, reactive systems.	3(3-0-9)	2110772	Multi-Dimensional Database Systems Modern multi-dimensional database systems : spatial databases, temporal databases, multimedia databases; algorithms and data structures : R-tree, R+ tree, R* tree, quad-tree, spatial and temporal reasoning, disk clustering and declustering.	3(3-0-9)
2110742	Evolutionary Computation Computer algorithms gleaned from the model of biology; algorithms inspired by organic evolution : genetic algorithms, classifier systems, genetic programming and evolution strategies; theoretical basis of these algorithms.	3(3-0-9)	2110773	Data Mining Data mining concepts; data mining applications; data mining methodologies: decision trees, classification, association, clustering, statistical modeling, Bayesian classification, k-nearest neighbors.	3(3-0-9)
2110743	Machine Learning Computing with logic; using logic set theory, number theory, algebras graph theory, automata; language of first order logic, model theory and logic programming; problems of inductive inference in the framework of first-order predicate calculus and the probability calculus; introduction of computational learning theory.	3(3-0-9)	2110779	Advanced Topics in Computer Graphics In-depth study of selected current and interesting topics in computer graphics; hardware architecture, graphics systems, picture/image generation, graphics utilities, computational geometry and object modeling, methodology and techniques, three-dimensional graphics and realism and current applications.	3(3-0-9)
2110744	Machine Vision Low-level vision and higher-level techniques : binary machine vision, morphology, neighborhood operators, labeling, texture, region segmentation, feature extraction, motion, image matching, model matching and knowledge-based vision systems.	3(3-0-9)	2110781	Special Topics in Distributed Systems Current topics, related researches, and technology trends in distributed systems.	3(3-0-9)



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Mathematical Logic: Set, Relation, Function, Predicate Calculus, Algebraic system; Formal software specification language: Z, CafeOBJ; Identifying problem domain; Design and software modeling; Formal software specification method; Consistency verification of formal specification and its proof; Utilization of formal software specification in software process.

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2110661 Computer Network 3(3-0-9)
Introduction to network and network components; transmission links and protocols; design and analysis of networks; WAN; IMP; topology; network protocols; flow control and routing techniques.

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2110671 Database Management Systems 3(3-0-9)
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2110672 Data Modeling Techniques 3(3-0-9)
Data modelling concepts; conceptual objects used on simple and complex abstraction level: entity and entity set, entity attributes, relationship and relationship sets, relationship attributes, domain; normalization of relation: INF, 2NF, 3NF, 4NF and 5NF; conceptual data modeling: entity-relationship, data flow, logical and physical model, transformation of the logical model into a physical model, and functional design; object-oriented design concept.

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Microcontroller architecture (RAM, ROM, CPU), I/O, and peripheral devices, I/O interfacing, real-time operating systems, real-time constraints, scheduling theory, real-time system design methodology, case studies.

