Catalog Description

Computer Engineering

1. Information Systems and Web Technology Courses

200-501 Research Methodology in Engineering 3((3)-0-6)

Definition, classification of research, research ethics, research topic and problem, research objective, scope of research, literature review, research proposal writing, statistical method for engineering research, research methodology, analysis and interpretation of data, research presentation, research report writing, case studies, research communication, and research management are essential components of the research process that collectively provide a comprehensive framework for conducting systematic and effective scholarly investigation.

240-510 Advanced Database Concepts and Applications 3((3)-0-6)

Database models and systems, relational and non-relational database design theory, query languages and processing, enterprise database development, data mining and information retrieval systems, modern database technologies, and real case studies from medical or industrial business sectors collectively represent the fundamental and applied aspects of database systems, covering theoretical foundations, practical implementation, advanced data analysis techniques, and real-world applications across healthcare and industry.

240-511 Module: Modern Web and Multiplatform Application Development Technology 6((3)-6-9)

Components, Models and Types of Web Application Architecture Components, models and types of web application architecture; full stack web technology development; criteria for choosing a modern web technology stack; front-end web UI frameworks and tools; front-end JavaScript frameworks; hybrid and cross-platform mobile application development frameworks; case studies from industrial sector.

240-512 Module: Engineering and Management in Software Project Management with ISO/IEC 29110 6((3)-6-9)

Standard The need of lightweight systems and software project management in very small entities; ISO/IEC 29110 standard; project management objectives practices; software implementtation objectives practices; case studies from industrial sector.

240-513 Module: Data Engineering Principles and Applications Module 6((3)-6-9)

Information engineering design and systems; technologies for information processing and distribution on mobile devices; multimedia and computing convergence; multimedia service management for home network; case studies in public mobile telecommunication systems applications

240-529 Special Topics in Information Engineering I 3((3)-0-6)

Special topics in the development of the new technology in information engineering according to the approval granted by the Program Committee.

240-610 Service-Oriented Architecture for IoT Applications 3((3)-0-6)

Service-oriented architecture design technologies; composition of heterogeneous web services; quality-of-service aware service provisioning for IoT applications; case studies in cloud and edge services in IoT environments; case studies from industrial sector.

240-611 Semantic Web Technology and Applications 3((3)-0-6)

Web Intelligence; knowledge representation for the semantic web; ontology engineering; discovering information – querying; semantic web applications and services; semantic web programming; graph database; quality training data for machine learning; case studies in industrial and architectural sector.

240-612 Web Content Accessibility Technology for Disability Users 3((3)-0-6)

Accessible web design technology and web content accessibility guidelines (WCAG); accessibility in UI design; web accessibility validation tools; user experience (UX) design guideline for people with disabilities; adaptation techniques to improve web accessibility for disability users; case studies for visually impaired or learning disability users.

240-629 Special Topics in Information Engineering II 3((3)-0-6)

Special topics in the development of the new technology in information engineering according to the approval granted by the Program Committee.

2. Computer System Design and Algorithmic Foundations

240-530 Experimental Design in Computer Engineering 3((3)-0-6)

Experimental case studies in computer engineering: exemplary depth, standard practices, innovative designs, and unforeseen flaws; independent project: design and execute experiments for either students' own research or prior work; results visualization; constructive criticism and discussion on each other's designs.

240-531 Advanced Unix Programming 3((3)-0-6)

Unix network development using C programming necessary tools; file structure; directory protocol; standard library for input and output; file system; Unix process environment, process relation, process communication, demon process; terminal for input and output.

240-532 Scientific and Engineering Programming 3((3)-0-6)

Programming; computing with formulas; data structure; loops and lists; functions; input; error handling; array computing; discrete calculus; differential equations; visualization.

240-533 Algorithm Design and Analysis 3((3)-0-6)

Role of algorithms in computing; divide-and-conquer; growth of functions; dynamic programming; greedy algorithms; elementary graph algorithms, shortest path problems,minimum spanning trees, maximum flow; string matching; computational geometry; NP-completeness; approximation algorithms.

240-534 Module: Parallel and Distributed Simulation Systems 6((3)-6-9)

Parallel and distributed processing; hardware platforms and simulation fundamentals; discrete event simulation basics and systems; distributed virtual environments, parallel discrete event simulation; dead reckoning model; data distribution; time synchronization and management; real-time simulations; algorithms

and protocols; deadlock detection and recovery; standards and frameworks: high-level architecture, data distribution services; data case studies.

240-535 Module: High Performance Computing 6((3)-6-9)

Computer architecture; CPU architecture; GPGPU; cluster; parallel and distributed systems; scheduling; load balancing; performance analysis; performance tuning; scientific computing; quantum computing; case study.

240-539 Special Topics in Computer System Design I 3((3)-0-6)

Special topics in the development of the new technology in computer system design according to the approval granted by the Program Committee.

240-630 Modern Distributed Systems 3((3)-0-6)

Introduction to distributed system; architecture; processes; communication; synchronization; consistency and replication; fault tolerance; security; container; case study.

240-631 Software Architectural Patterns 3((3)-0-6)

Software architecture; elements of software architecture design; layered pattern; client-server pattern; master-slave pattern; pipe-filter pattern; broker pattern; peer-to-peer pattern; event-bus pattern; model-view-controller pattern; blackboard pattern; interpreter pattern, real case studies from medical or industrial business sectors.

240-631 Software Architectural Patterns 3((3)-0-6)

Software architecture; elements of software architecture design; layered pattern; client-server pattern; master-slave pattern; pipe-filter pattern; broker pattern; peer-to-peer pattern; event-bus pattern; model-view-controller pattern; blackboard pattern; interpreter pattern, real case studies from medical or industrial business sectors.

240-632 Cloud Computing Principle and Paradigm 3((3)-0-6)

Cloud concepts and technologies; virtualization; scalability and elasticity; cloud-based services and models; load balancing; monitoring and management; performance and benchmarking; cloud service examples; case studies.

240-633 Big Data System Architecture 3((3)-0-6)

Big data definition; big data database; distributed file system; data flow; map/reduce; stream processing; visualization; real case studies from medical or industrial business sectors.

240-639 Special Topics in Computer System Design II 3((3)-0-6)

Special topics in the development of the new technology in computer system design according to the approval granted by the Program Committee.

3. Embedded Systems and Internet of Things (IoT)

240-540 Embedded and Real Time Systems 3((3)-0-6)

Embedded system design for Real-time responsibility, technology of processor, microcontroller, sub-processors, and software-Hardware partition, problem solving with entrepreneur via Entrepreneurship; real case studies from medical or industrial business sectors.

240-541 Module: Low Power Processor Architectures and Programming 6((3)-6-9)

Low power programming, energy efficient programming, dynamic voltage scaling, CPU frequency scaling, sleep modes, coprocessors, SIMD unit and its programming model, multi-core SIMD processors, energy measurement, performance evaluation, optimization methods; real case studies from medical or industrial business sectors.

240-549 Special Topics in Embedded & IoT I 3((3)-0-6)

Special topics in the development of the new technology in Embedded System & IoT according to the approval granted by the Program Committee.

240-640 Testing and Testable Design of Digital Systems 3((3)-0-6)

Faults and fault modeling, test equipment, test generation for combinational and sequential circuits, fault simulation, memory and microprocessor testing, design for testability, built-in self-test techniques, and fault location; real case studies from medical or industrial business sectors.

240-641 Multi-core Architectures and Multi-core Programming 3((3)-0-6)

Multi-core architectures; concept of parallel programming; thread-level parallelism; design patterns for parallel programming; debugging parallel programs; SIMD instructions; MMX instruction set; SSE instruction set; AVX instruction set; performance analysis and optimization; development tools.

240-649 Special Topics in Embedded & IoT II 3((3)-0-6)

Special topics in the development of the new technology in Embedded System & IoT according to the approval granted by the Program Committee.

4. Computer Networks and Cybersecurity

240-550 Module: Cybersecurity 6((3)-6-9)

Cybersecurity technology; cybersecurity risk assessment and management; cybersecurity threats and defense; critical infrastructure control systems security; designing and securing cyber-physical systems; ethical hacking; malicious software analysis and defense; incident handling; system security; information security; network security; ISO27000; security and privacy; vital organization practices; real case studies from medical or industrial business sectors

240-551 Cryptography and Blockchain 3((3)-0-6)

Algebra, encryption technology, digital signatures, hashing, cryptocurrency, blockchain ecosystem, smart contracts, blockchain commercial use cases, case studies.

240-569 Special Topics in Computer Networks I 3((3)-0-6)

Special topics in the development of the new technology in computer networks according to the approval granted by the Program Committee.

240-649 Special Topics in Embedded & IoT II 3((3)-0-6)

Special topics in the development of the new technology in Embedded System & IoT according to the approval granted by the Program Committee.

240-650 Principle of Wireless Netwroks [sic] 3((3)-0-6)

Overview of wireless communications, wireless channel, wireless signals, radio frequency propagation, radio frequency communications, antenna, wireless personal area networks, wireless local area networks, wireless metropolitan area networks, wireless wide area networks, cellular networks, satellite networks.

240-651 (Cryptography and Network Security) 3((3)-0-6)

Classical cryptography; modern cryptography, symmetric key cryptography, asymmetric key cryptography; authentication, message authentication, entity authentication, certificate, digital signature, hash function; key distribution and key agreement; network security; case studies.

240-653 Routing and Switching Principles 3((3)-0-6)

Ethernet framing; IP addressing; ICMP; ARP; TCP/IP; routing platform; ethernet switching; spanning tree protocol; IP unicast routing; OSPF; DHCP; FTP; telnet; VLAN; NAT; network management; SNMP; IPv6 networks; MPLS; real case studies from medical or industrial business sectors.

240-669 Special Topics in Computer Networks II 3((3)-0-6)

Special topics in the development of the new technology in computer networks according to the approval granted by the Program Committee.

5. Computer Control and Intelligent Systems

240-570 Image Processing 3((3)-0-6)

Physical properties transform to digital data; principle of image formation, light, colors, reflection and surface texture; statistic image processing; image recognition and classification; real case studies from medical or industrial business sectors.

240-571 Signals and Systems 3((3)-0-6)

Signal and systems; linear time-invariant systems; fourier series representation of periodic signals; continuous-time fourier transform; discrete-time fourier transform; time and frequency characterization of signal and systems; sampling; laplace transform; Z-transform; frequency response; transfer function; poles and zeros.

240-572 Module: Machine Vision 3((3)-0-6)

Computer vision: Image acquisition, nature of images, homogeneous transformations, camera technologies and vision systems design, filtering, edge detection, Features detection, contours, segmentation, morphological operators, camera model, intrinsic and extrinsic camera parameters, camera calibration, motion detection, optical flow, object tracking, motion capture, three-dimensional imaging: epipolar geometry, stereoscopic vision, active range imaging, structured lighting, modeling techniques for autonomous systems, data fusion, pose estimation, quality control, mapping and robot guidance, activity monitoring, motion estimation, autonomous systems, biomedical imaging; real case studies from medical or industrial business sectors.

240-573 Module: AI for Next Generation Robotics 6((3)-6-9)

Estimation theory, mobility mechanisms, multi-agent negotiation, natural language interfaces, machine learning, active computer vision, probabilistic models, and the modeling and integration of visual, haptic, auditory and motor information, reinforcement learning, behavior generation in robots, Model-based and

model-free, value-function-based and policy-search methods, effective representations, approximate models, prior knowledge, active perception, spatial cognition, coordinate and navigate strategies, Bayesian approaches, deep understanding, simulation, practice in Python and in open AI, case Study.

240-574 Module: Machine Deep Understanding 3((3)-0-6)

Deep learning, neural networks, convolutional networks, RNNs, LSTM, Adam, Dropout, batch norm, Xavier/He initialization. case studies from healthcare, autonomous driving, sign language reading, music generation, and natural language processing, practice in Python and in Tensorflow. language of uncertainty, Bayesian deep learning, uncertainty quality, application, deep insights, deep reinforcement learning, metacognition, cognitive learning theory, cognitive machine to cognitive system; real case studies from medical or industrial business sectors.

240-574 Module: Machine Deep Understanding 3((3)-0-6)

Deep learning, neural networks, convolutional networks, RNNs, LSTM, Adam, Dropout, batch norm, Xavier/He initialization. case studies from healthcare, autonomous driving, sign language reading, music generation, and natural language processing, practice in Python and in Tensorflow. language of uncertainty, Bayesian deep learning, uncertainty quality, application, deep insights, deep reinforcement learning, metacognition, cognitive learning theory, cognitive machine to cognitive system; real case studies from medical or industrial business sectors.

240-589 Special Topics in Computer Control Systems and Intelligent Systems I 3((3)-0-6)

Special topics in the development of the new technology in computer control systems and intelligent systems according to the approval granted by the Program Committee.

240-670 Digital Signal Processing 3((3)-0-6)

Signal; Signal processing; discrete-time signals, discrete-time systems; linear time-invariant system; difference equation; convolution; continuous-time Fourier transform; discrete-time Fourier transform; frequency response of a system; sampling and quantization; sampling of continuous-time signals; analog filter design; discrete Fourier transform; circular convolution; linear convolution using discrete Fourier transform; fast Fourier transform; z-transform; region of convergence; Inverse z-transform; pole and zero; transfer functions; digital filter design.

240-671 Speech and Audio Signal Processing 3((3)-0-6)

Speech production; speech perception; speech recognition systems; feature extraction techniques; Mel frequency cepstral coefficients; linear predictive coding; Hidden Markov model; deep learning neural networks for speech recognition; tools for speech recognition; large vocabulary continuous speech recognition; language modeling; speech synthesis; speech synthesis techniques; text-to-speech systems; real case studies from medical or industrial business sectors.

240-672 Principles of Pattern Recognition 3((3)-0-6)

Pattern recognition, pattern recognition systems, supervised learning, unsupervised learning; Bayesian decision theory; classifiers; minimum-error-rate classification; discriminant functions; decision surfaces; Gaussian density; maximum-likelihood parameter estimation; Bayesian parameter estimation; Principal Component Analysis; feature selection; k-means clustering; Hidden Markov models; linear discriminant functions; neural networks; fuzzy logic classification; real case studies from medical or industrial business sectors.

240-673 Advanced Image Processing 3((3)-0-6)

Image processing, principle of image formation; digital image acquisition; display using digital devices; statistic image processing and two-dimensional transforms; image distortion correction; linear and nonlinear filtering; morphological operations; contrast enhancement; noise removal; image de-blurring; image registration; geometric transformation; edge detection; feature extraction; motion analysis; object tracking; object classification; real-time image processing; real case studies from medical or industrial business sectors.transform; z-transform; region of convergence; Inverse z-transform; pole and zero; transfer functions; digital filter design.

240-674 Machine Learning 3((3)-0-6)

Supervised learning; linear regression; additive models; maximum likelihood; active learning; classification; logistic regression; regularization; Support Vector Machines; feature selection; combination of methods; boosting; complexity; structural risk minimization; description length; mixture models; Expectation–Maximization (EM); conditional mixtures; non-parametric density estimation; unsupervised learning, clustering; Principal Component Analysis (PCA) and Independent Component Analysis (ICA); Markov models; Hidden Markov models; Bayesian networks; medical diagnosis example; reinforcement learning, conclusion; real case studies from medical or industrial business sectors.

240-689 Special Topics in Computer Control Systems and Intelligent Systems II 3((3)-0-6)

Special topics in the development of the new technology in computer control systems and intelligent systems according to the approval granted by the Program Committee.

6. Seminar, Thesis, and Research Requirements

200-502 Seminar in Engineering 1(0-2-1)

Literature survey in libraries and other sources to follow the progress in topic of interested in engineering program and related areas; participation in presentation and discussion in seminar in order to train research publication reading, writing, and presentation skills under supervision of course instructors; presentation of knowledge application to solve problems.

240-702 Seminar II (Research Proposal Writing) 1(0-2-1)

Literature survey in libraries and other sources to follow the progress in topics of interested in computer engineering and related areas; participation in presentation and discussion in the department seminar in order to train research proposal writing and presentation skills.

240-703 Seminar III (Research Article Writing) 1(0-2-1)

Literature survey in libraries and other sources to follow the progress in topics of interested in computer engineering and related areas; participation in presentation and discussion in the department seminar in order to train research proposal writing and presentation skills.

240-800 Thesis 21(0-63-0)

Research on topics of interested in computer engineering under the supervision of advisors; presentation and oral examination every registered semester; preparation of thesis in proper form.

240-801 Thesis 36(0-108-0)

Research on topics of interested in computer engineering under the supervision of advisors; presentation and oral examination every registered semester; preparation of thesis in proper form.

240-802 Minor Thesis 6(0-18-0)

Independent study on topics of interested in computer engineering under the supervision of advisors; presentation and oral examination every registered semester; preparation of thesis in proper form.