

## Course Descriptions

### General Education Courses

#### Social Sciences

			Credits (Lecture-Lab)
SHSS	103	Man and Society	2 (2 – 0 – 4)
		Courses must come first : None	
		Students to learn together : None	
		Man as a social member. Structure and evolution of social human. Economical, legislative, political, governmental and environmental systems. Socio-culture change and their impacts. Adaptation and living in society culture.	
SHSS	107	Society and Health	2 (2 – 0 – 4)
		Courses must come first : None	
		Students to learn together : None	
		Social and cultural diversity as products of the modernized society. Culture and political economic structure. Pluralism of cultures, beliefs, behavior, values, identity, and ways of life among different social groups in the Thai and world society. Influences of social, economic, political, historical, cultural.	
SHHU	108	Human Relations and Self Development	2 (2 – 0 – 4)
		Courses must come first : None	
		Students to learn together : None	
		Principles and methods of cultivating human relations and self- development according to Buddhist perspective. For example, methods to develop a good relationship among colleagues and members in society, the art of teamwork, the administration according to the Buddhist teachings, the cultivation of right view and working ethos, Buddhist meditation, and art of public speaking.	

Credits (Lecture-Lab)

SHSS	116	Comparative Culture	2 (2 – 0 – 4)
		Courses must come first : None	
		Students to learn together : None	
		Principles and basic concepts in human communication, relation between language, culture and communication, contemporary communication situation analysis in the present society. Appropriate communicative skills in thinking, speaking, listening, reading and writing.	
ITGE	101	Problem Solving Techniques	2 (1 – 2 – 3)
		Courses must come first : None	
		Students to learn together : None	
		Necessary skills for life-long learning. Basic problem solving skills and techniques. Problem identification and inductive reasoning. Plan-Do-Check-Act in problem solving. Algorithm design and verbal reasoning. Learning and practicing the effective use of analytical skills. Setting up learning targets. Defining the problems. Searching for fact and information. Distinguishing between data and fact. Knowledge gathering skills. Thinking creatively and laterally. Problem-based, puzzle-based, and project-based learning. Experiments, Evaluations, and Presentations.	
ITGE	301	Communication Strategies in Professional Life	2 (2 – 0 – 4)
		Courses must come first : None	
		Students to learn together : None	
		Communication skills in listening, speaking, reading and writing. Communication in small groups, large groups and in public. Rapport building with other people in the society including subordinates, supervisors, and colleagues. Appropriate communication ways including email, telephone, and social network. Building effective network. Basic socialization. Negotiation and persuasion. Leading the meeting in a professional way. Learning negotiation techniques, and presentation tips.	

### **Basic Sciences and Mathematics**

Credits (Lecture-Lab)

SCCH	100	<p>Integrated Chemistry</p> <p>Courses must come first : None</p> <p>Students to learn together : None</p> <p>History of chemistry, the discovery of atoms and molecules; properties of elements and formation of compounds. Natural phenomena related to the behavior and properties of molecules in gaseous, liquid and solid states. Chemical reactions in daily life and factors influencing the reactions. Natural compounds and modern materials with designed properties. Study of the energy formations from chemical reactions, Science development and its impact to living things, environment and medicine. The problem solving in science and technology development.</p>	3 (3 – 0 – 6)
SCBI	109	<p>Integrated Biology</p> <p>Courses must come first : None</p> <p>Students to learn together : None</p> <p>A basic course for the non-major in Biology. It is designed for students to understand the major biological principles with emphasis on the fundamental characteristics of living organisms from cellular level to ecosystem. Topics include cell structure and function, genetics, evolution, diversity of life and ecology. Discussion of concepts of biology with global issues focusing on contemporary problems such as population dynamics, biotechnology, bioinformatics and human health.</p>	3 (3 – 0 – 6)
ITCS	161	<p>Physical Science and Computation</p> <p>Courses must come first : None</p> <p>Students to learn together : None</p> <p>Applying computers to help solve computational problems in physical sciences such as physics, chemistry, biology, geology and environmental science. Analysis and solving mathematical and scientific problems using computation models. Using software developed for mathematical and scientific computation. Creation of virtual world that represents a physical world. Study of human being's relationship to the digital world. Modeling</p>	3 (3 – 0 – 6)

physical systems using software and hardware that can sense and respond to the real world environment.

\*ITCS 475 Mathematical Programming 3 (3 – 0 – 6)

Courses must come first : None

Students to learn together : None

Linear programming. Integer linear programming. Zero-one integer programming. Branch and bound algorithms. Dynamic programming. Transportation problem. Traveling Salesman problem. Optimization on networks such as shortest path problem and minimum spanning tree problem. Network scheduling problems.

### Languages

Credits (Lecture-Lab)

ITLG 101 Technical English I 2 (1 – 2 – 3)

Courses must come first : None

Students to learn together : None

English language skills for university level course work. Emphasis on basic communication skills in listening and speaking. Basic grammar and reading comprehension skills. Vocabulary related to computers and information technology.

ITLG 102 Technical English II 2 (1 – 2 – 3)

Courses must come first : None

Students to learn together : None

English language skills for university level course work. Emphasis on basic skills in reading and writing. Writing short articles and technical reports. Intermediate grammar. Vocabulary related to computers and information technology.

ITLG 201 Reading Skills 2 (1 – 2 – 3)

Courses must come first : None

Students to learn together : None

Reading principles and practices. Computer and ICT related vocabulary. Semi-technical vocabulary. Basic concepts in reading comprehension. Effective reading strategies. Understanding of sentence structures. Word meaning from context for getting main ideas and details. Techniques in reading various materials such as textbooks, novels, newspaper, business reports and research articles.

ITLG 202 Public Speaking and Presentation 2 (1 – 2 – 3)

Courses must come first : None

Students to learn together : None

Basic English pronunciation. Principles of effective speaking such as relaxation, breath control, articulation, resonance and projection. Presentation skills including preparation, audio and visual aids, overcoming stress, gestures, handling questions and answers. Practice in delivering an oral presentation in front of the class in general topics and in ICT related topics.

ITLG 301 Business Writing 2 (1 – 2 – 3)

Courses must come first : ITLG 201

Students to learn together : None

Strategies and techniques for writing in English. Different writing formats in one paragraph. Usage of words and vocabularies. Structure and forms of writing for different objectives. Practice of writing ICT reports.

ITLG 302 Academic Writing 2 (1 – 2 – 3)

Courses must come first : ITLG 201

Students to learn together : None

Writing reports, professional articles, technical papers, abstracts and research papers with attention to appropriateness of vocabulary, idioms, style, register and genre. Practice of writing technical ICT reports.

## Health

Credits (Lecture-Lab)

SPGE 102 Yoga for Health 1 (0 – 2 – 1)

		Courses must come first : None	
		Students to learn together : None	
		History, meaning, training locations and equipment, and benefits of Yoga. Body preparation, joint and muscle stretching, Techniques of muscle contraction and relaxation. Practice of Asana (body position/posture), breathing control, Pranayama , deep relaxation and Yoga training safety.	
SPGE	105	Soccer	1 (0 – 2 – 1)
		Courses must come first : None	
		Students to learn together : None	
		Brief history of soccer encompassing; benefit ,equipment, rule and regulations, physical fitness. Basic skills of kicking , passing, heading, dribbling, throwing and team play. Equipment keeping, risks injuries and safety. Soccer for exercise, health and recreation.	
MSMS	107	Film Appreciation	2 (2 – 0 – 4)
		Courses must come first : None	
		Students to learn together : None	
		The definitions, role and functions of Films. Survey into genres, film styles, history of films, and development in both Eastern-Western Cinematographic worlds as well as films in Thailand. Elements of film creation. Films exploration. Principles of aesthetic evaluation in Films	
MSID	101	Music Appreciations	2 (1 – 2 – 3)
		Courses must come first : None	
		Students to learn together : None	
		The understanding of the evolution of western and global music cultures, considering both their forms and their social and economic foundations, which will lead to the better understandings of other music cultures as well as the comparison and the futures of Thailand's music cultures.	
ITGE	141	Digital Photography	1 (0 – 2 – 1)
		Courses must come first : None	
		Students to learn together : None	

Camera equipments and components. Lenses and Flash. How camera works. Focal length and aperture. Digital camera and human eyes. Pixels and resolution. Photo editing. Tones and contrast. Luminosity and color. Image sharpening. Digital image interpolation. Color management and printing.

ITGE 142 Digital Drawing and Painting 1 (0 – 2 – 1)

Courses must come first : None

Students to learn together : None

Theory and practice of designing and drawing lines. Drawing of a variety of shapes such as geometric shapes and natural shapes. Perspective drawing. Theory of colors. Color cycle. Techniques of painting. Practice of basic drawing and painting by hands. Use of graphical software. Production of creative graphics. Applications of drawing and painting to several forms of media such as publishing, video and animation.

## Specific Education Courses

### Core courses

Credits (Lecture-Lab)

ITCS	125	Applied Statistics for Computing	3 (3 – 0 – 6)
		Courses must come first : None	
		Students to learn together : None	
		Probability and properties. Conditional probability. Independence of events. Baye's rule. Random variables. Discrete and continuous probability functions. Expected values and variances. Probability functions. Sampling distributions. Estimation and hypothesis testing. Contingency tables. Simple linear regression and correlation. Applying statistical techniques for solving computing problems using statistical packages.	
ITCS	175	Advanced Mathematics I for Computer Science	3 (3 – 0 – 6)
		Courses must come first : None	
		Students to learn together : None	
		Limits. Continuity. Differentiation. Derivatives of functions. Techniques of integration. Improper integrals. Vector addition. Vector multiplication. Scalar	

product. Cross product. Vector valued functions. Parametric equations. Matrices. Determinants. Systems of linear equations. Euclidean space. Eigen values and eigenvectors. Applying mathematics for solving computing problems.

ITCS	306	Numerical Method	3 (3 – 0 – 6)
		Courses must come first : None	
		Students to learn together : None	
		Introduction to numerical methods. Mathematical background. Solving nonlinear equations. Solving a system of linear equations. Curve fitting and interpolation. Numerical differentiation. Numerical integration. Ordinary differential equations. Initial-value problems. Boundary-value problems. Mathematical software used for numerical computation.	
ITCS	320	Discrete Structures	3 (3 – 0 – 6)
		Courses must come first : None	
		Students to learn together : None	
		Sets. Functions. Relations. Basic logic and Boolean algebra. Proof techniques such as direct proofs, proof by counter example, proof by contradiction. Mathematical induction. Well orderings. Basic counting such as Pigeonhole principle. Permutations and combinations. Recurrence relations. Graphs and trees. Finite state machines and regular expressions.	

### Compulsory courses

			Credits (Lecture-Lab)
ITCS	200	Fundamentals of Programming	3 (3 – 0 – 6)
		Courses must come first : None	
		Students to learn together : None	
		Structured programming. Problem-solving techniques. Development and implementation of basic algorithms in a procedure-oriented language. A systematic approach to the design and construction of computer programs. Fundamentals of high-level, block-structured languages including arrays, procedures, parameters, recursion. Basic data structures.	



ITCS	208	<p>Object Oriented Programming</p> <p>Courses must come first : ITCS 200</p> <p>Students to learn together : None</p> <p>Concepts in object-oriented programming. Encapsulation and information hiding. Classes and subclasses. Inheritance and overriding. Polymorphism. Class hierarchies. Internal representations of objects and method tables.</p>	3 (3 – 0 – 6)
ITCS	210	<p>Web Programming</p> <p>Courses must come first : ITCS 200</p> <p>Students to learn together : None</p> <p>Fundamental mechanism and components of the Internet and Web. Formats and structures of languages used to develop webs. Web page creation. The techniques of writing script programs working at client and server sides. Web development tools. Program for simulating a web server. Database management system. System development for accessing the database. Applications of object-oriented programs to web development.</p>	3 (3 – 0 – 6)
ITCS	211	<p>Introduction to Digital Systems</p> <p>Courses must come first : ITCS 200</p> <p>Students to learn together : None</p> <p>Introduction to logic design. Concepts in digital systems. Binary systems. Boolean algebra and Logic gates. Karnaugh maps and its simplification. Combinational circuit. Sequential circuit. Digital Hardware realization. Microprocessor structure and programming.</p>	3 (3 – 0 – 6)
ITCS	222	<p>Computer Organization and Architecture</p> <p>Courses must come first : ITCS 211</p> <p>Students to learn together : None</p> <p>Organization and architecture of computer systems. Basic components of computers. Data representation. Assembly Language. Memory system organization and architecture. Memory hierarchy and interleaving. Cache memory. Virtual memory. Input and Output systems. Storage systems. CPU design. Additional computing units. Implementation of data paths and control unit. Multiprocessor architecture.</p>	3 (3 – 0 – 6)
ITCS	231	<p>Data Structures and Algorithm Analysis</p>	3 (3 – 0 – 6)

Courses must come first : ITCS 200

Students to learn together : None

Basic data structures such as stacks, queues, lists, arrays, strings, trees, sets and graphs. Design and evaluation of algorithms for manipulating data structures such as searching, sorting and hashing. Brute-force algorithms. Greedy algorithms. Divide-and-conquer. Backtracking. Heuristics. Pattern matching and string matching algorithms.

ITCS 241 Database Management Systems 3 (3 – 0 – 6)

Courses must come first : ITCS 231

Students to learn together : None

Basic database management. Data models. Database design cycles. Relational database design. Data normalization. Data organization in normalized forms. Data description languages. Data query. Data consistency. Data recovery and synchronization control. Data security. Data integrity and reliability.

ITCS 335 Introduction to E-business Systems 3 (3 – 0 – 6)

Courses must come first : ITCS 241

Students to learn together : None

Structured programming. Problem-solving techniques. Development Electronic commerce fundamentals. E-business models. Value chain analysis. Technology architectures for electronic business. Supply chain management. Consumer behavior within electronic environment. Legal and ethical issues. Privacy and security of electronic information.

ITCS 336 Human Computer Interface 3 (3 – 0 – 6)

Courses must come first : ITCS 381

Students to learn together : None

Principles of graphical user interfaces. Graphical user interfaces toolkits. Interaction styles and techniques including screen design, layout, color, fonts, labeling and visual programming. HCI tools. Multimedia and web communication. Human-centered development and evaluation. Human performance models: perception, movement, cognition, culture, communication, and organizations. Accommodating human diversity.

		Principles of good design and good designers. Engineering tradeoffs. Introduction to usability tests.	
ITCS	343	Principles of Operating Systems Courses must come first : ITCS 222 Students to learn together : None Basic principles of operating systems. Computer resource management. Process management and scheduling. Multitasking and multiprocessing systems. Synchronization. Deadlocks. Mutual exclusion. Memory management: segmentation and paging. Virtual memory. Protection. Sharing. Access control. File and I/O systems.	3 (3 – 0 – 6)
ITCS	361	Management Information Systems Courses must come first : ITCS 241 Students to learn together : None Concepts in the administration of information system functions in organizations. Enhancement of management with computers. Management system development. Planning and budgeting. Analysis, design, implementation and operation. Success factors including privacy, ethics, job security, job changes. Information security. Measurement of operating performance. Ethics in management information systems. Business process engineering and information technology between organizations such as electronic data interchange and electronic commerce.	3 (3 – 0 – 6)
ITCS	371	Introduction to Software Engineering Courses must come first : ITCS 241 Students to learn together : None Software engineering foundations and concepts. Requirements management. Procedures of software development. Standards models for software engineering model construction. Software engineering model analysis. Basic object-oriented design. Fundamentals of software project management.	3 (3 – 0 – 6)
ITCS	381	Introduction to Multimedia Systems Courses must come first : ITCS 231	3 (3 – 0 – 6)

		Students to learn together : None	
		Multimedia tools. Web hypermedia. Communication. Categorization and architectures of information: hierarchies and hypermedia. Information retrieval and human performance. Web search. Usability of database query languages. Models of color, fonts, texts, images, and sound. Natural language processing. Overview of multimedia information systems; Tools and processing on mobile devices. Data compression. Computer animation.	
ITCS	402	Computer and Business Ethics	3 (3 – 0 – 6)
		Courses must come first : None	
		Students to learn together : None	
		Roles and impact of computer usage in the society, school, and workplace. Computer abuse. Computer crime. Privacy and anonymity. Intellectual property and legal issues. Professional social responsibility and globalization. Computer ethics fallacies. Computer game fallacy. Law abiding. Public comment and privacy rights. Software piracy and plagiarism. Hacker’s fallacy and ethics. Free and open information fallacy. Hacking and hacktivism. Ethics codes of conduct and resources. Internet Architecture Board. Computer Ethics Institute (CEI). Organizational Ethics Plan of Action. Social implications of computers.	
ITCS	414	Information Storage and Retrieval	3 (3 – 0 – 6)
		Courses must come first : ITCS 231	
		Students to learn together : None	
		Concepts, principles, techniques, and mechanism of information storage and retrieval. Retrieval modeling. Boolean model. Inverted index. Tolerant retrieval techniques. Index construction. Term weighting. Vector model. Scoring and ranking. Retrieval documents. Main components of information retrieval system. Retrieval evaluation. Relevant feedback. Query expansion. XML retrieval. Vector space classification. Matrix decomposition. Latent Semantic Indexing. Web Search Basics.	
ITCS	420	Computer Networks	3 (3 – 0 – 6)
		Courses must come first : ITCS 323	
		Students to learn together : None	

History and evolution of computer networks and the Internet. Types and standards of computer networks particularly packet-switched network and circuit-switched network. Specific characteristics of different types of computer networks. Mechanisms of each layer of the Internet including path discovery and computer addressing in the Internet, the stability improvement via the use of TCP and UDP in the communication, and the development of software applications running on top of TCP and UDP. Applications of network systems and the security in computer networks.

ITCS 424 Wireless and Mobile Computing 3 (3 – 0 – 6)

Courses must come first : ITCS 420

Students to learn together : None

History, evolution, and compatibility of wireless standards. Characteristics of wireless and mobile computing. Wireless LAN. Mobile IP. Mobile aware applications. Mobile data access. Basic programming for mobile devices. Principles of communication in mobile phones. Security in wireless LAN. Performance of wireless and mobile computing.

ITCS 443 Parallel and Distributed Systems 3 (3 – 0 – 6)

Courses must come first : ITCS 343

Students to learn together : None

Concepts of parallel and distributed systems. Parallel and distributed architecture and examples. Communication and synchronization mechanisms. Parallel programming in MPI (Message passing interface). Message passing mechanism. Parallel algorithms such as parallel sorting, parallel searching. Performance evaluation and load balancing. Cluster and GRID computing system. Cloud computing and applications.

ITCS 451 Artificial Intelligence 3 (3 – 0 – 6)

Courses must come first : ITCS 231

Students to learn together : None

History and evolution of artificial intelligence. Fundamental concepts, principles and techniques of artificial intelligence. Searching methods. Solving problems by solution searching. Symbolic computation. Expert

systems. Uncertainty handling in expert systems. Intelligent systems. Computational intelligence techniques. Fuzzy logic. Neural networks. Genetic algorithms. Case studies of artificial intelligence applications.

ITCS	461	Computer and Communication Security	3 (3 – 0 – 6)
		Courses must come first : ITCS 343 and ITCS 420	
		Students to learn together : None	
		Introduction to security systems, encryption, cryptanalysis, data encryption standard. Cryptographic techniques and protocols in communication. Applications of cryptography regarding management. Public key systems, digital signatures, file security systems. Penetration of database systems.	
ITCS	491	Senior Project I	3 (3 – 0 – 6)
		Courses must come first : The approval of an advisor	
		Students to learn together : None	
		Topics of an undergraduate-level project in Information and Communication Technology with the approval of a senior project advisor.	
ITCS	492	Senior Project II	3 (3 – 0 – 6)
		Courses must come first : ITCS 491 and The approval of an advisor	
		Students to learn together : None	
		Topics of an undergraduate-level project in Information and Communication Technology with the approval of a senior project advisor.	

### Major Elective Courses

			Credits (Lecture-Lab)
ITCS	331	Organization of Programming Languages	3 (3 – 0 – 6)
		Courses must come first : ITCS 208	
		Students to learn together : None	
		Fundamental principles and techniques in the design and implementation of modern programming languages. Languages definition structure. Programming language processing. Data types and structures. Control structures and data flow. Storage management. Syntax and translation. Programming language paradigms including procedural, functional, object-	

oriented and logic languages. Language concepts including values, bindings, types, and modules.

ITCS	362	<p>Geographic Information Systems</p> <p>Courses must come first : ITCS 241</p> <p>Students to learn together : None</p> <p>Introduction to geographic information systems: Definitions, concepts and applications. GIS Software development tools. Spatial data. Database management and manipulation. Mapping concepts and projection system. Digitization. Spatial data correction and integration. Registering raster image. Analysis of discrete entities in space. Analysis of continuous entities in space. Statistical analysis for GIS. Global Positioning System. Geo-processing. Web map server.</p>	3 (3 – 0 – 6)
ITCS	364	<p>Knowledge Management</p> <p>Courses must come first : ITCS 361</p> <p>Students to learn together : None</p> <p>Introduction to knowledge management: Definitions, concepts and applications. The nature of knowledge. Knowledge management solutions. Organizational impacts of knowledge management. Factors influencing knowledge management. Knowledge management assessment of an organization. Knowledge management technologies such as artificial intelligence and digital libraries. Preserving and applying human expertise and knowledge-based systems. Using past history explicitly as knowledge and case-based systems. Knowledge elicitation and converting tacit knowledge to explicit. Discovering new knowledge and data mining. Text KM and text mining. Knowledge discovery systems. Knowledge capture systems such as concept maps, process modeling, RSS, Wikis methods. Knowledge sharing systems such as ontology, categorization and classification tools, XML-based tools. Knowledge application systems. Conclusion and future of knowledge management.</p>	3 (3 – 0 – 6)
ITCS	365	<p>Information System Analysis and Design</p> <p>Courses must come first : ITCS 241</p> <p>Students to learn together : None</p>	3 (3 – 0 – 6)

		Information system development strategies. Problem identification and feasibility studies. Information requirements determination. Requirement analysis and logical specification. Logical design and physical design. Program development and testing.	
ITCS	366	Enterprise Architecture	3 (3 – 0 – 6)
		Courses must come first : ITCS 361	
		Students to learn together : None	
		Design, selection, implementation and management of enterprise IT solutions. Applications and infrastructure fit with the business. Frameworks and strategies for infrastructure management. System administration. Data and information architecture. Content management. Legacy system integration. System consolidation. Software selection. Total cost of ownership. IT investment analysis. Risk management and security. IT auditing with compliance standards.	
ITCS	367	IT Infrastructure Management	3 (3 – 0 – 6)
		Courses must come first : ITCS 361	
		Students to learn together : None	
		IT infrastructure components. Computer and system architecture. Network architecture. Services and capabilities of IT infrastructure in an organization. Knowledge and skills on hardware and system software technologies. Design of systematic processes. Decision for selecting software solutions for a particular IT infrastructure and system limitations. Techniques and roles to deal with several levels of vendors. Internet-based options. Computer and network security. Business continuity. Roles of infrastructure in regulatory compliance.	
ITCS	368	Information and Business Process Management	3 (3 – 0 – 6)
		Courses must come first : ITCS 361	
		Students to learn together : None	
		Methods and techniques to analyze, design, implement, automate, and evaluate business process. Structure of Business Process Management (BPM) life cycle. Analysis of the organization performance from a process perspective. Redesign processes using value-focused techniques. Design	



workflows. Simulation of new process designs. Process analytics applications using dashboards. Core concepts in data and information management. Identifying organization business requirements and business flows. Conceptual and relational data modeling. Verification of the structure with normalization techniques and development of a database application. Assessment of the efficiency and effectiveness of an organization from a process perspective. Process improvement. Roles of technology in supporting corporate processes. Design and develop applications to bridge the gap between business and information process.

ITCS 379 Practical Software Engineering 3 (3 – 0 – 6)

Courses must come first : ITCS 371

Students to learn together : None

Practice of software development using a standard process of software engineering: requirement analysis, software design, software construction, software testing, software quality assurance, software project planning and management.

ITCS 403 Introduction to Healthcare Systems 3 (3 – 0 – 6)

Courses must come first : ITCS 241

Students to learn together : None

Overview, organization, and roles in the healthcare systems for information technology professionals. Healthcare organizations in primary, secondary, and tertiary settings. Health policy. Financing in health systems. Medical terminologies. Disease processes and classifications. Clinical process and decision making. Pharmaceutical products and other treatment interventions. Ambulatory healthcare services and management. Hospital services and management. Emergency health services. Records of clinical care documents. Roles of healthcare professionals. Evidence-based medicine and healthcare knowledge management. Population health and epidemiology. Health data collection and analysis. Complexity of healthcare, information needs, and roles of technologies and information management in healthcare.

ITCS 404 Information Technology for Healthcare Services 3 (3 – 0 – 6)

Courses must come first : ITCS 241

Students to learn together : None

Overview of information technology applications in healthcare services. Development and management of information systems in healthcare. Information systems and process improvement. Hospital Information system. Clinical laboratory system. Database design in healthcare applications. Clinical information systems including admit, discharge, transfer (ADT) systems, electronic health records, computerized provider order entry (CPOE) systems, clinical decision support systems, medical imaging applications, and departmental information systems. Management information systems in healthcare organizations. E-Health including health information exchange and telehealth. Information privacy and security in healthcare.

ITCS 405 Information Models and Healthcare Information Standards 3 (3 – 0 – 6)

Courses must come first : ITCS 241

Students to learn together : None

(Unified Modeling Language )

Healthcare information management and information models. Interoperability and information standards in healthcare. Standard development process and organizations. Types of models. Common Information Model (CIM) and reference models. Unified Modeling Language (UML) and Extensible Markup Language (XML). Overview of important healthcare information standards including Health Level Seven (HL7), Standard Reference Information Model (RIM), Standard Clinical Document Architecture (CDA), Standard Continuity of Care Record (CCR), Continuity of Care Document (CCD), and Standard Digital Imaging and Communications in Medicine (DICOM). Standards of information in pharmacy and nursing. Terminologies and vocabularies in healthcare, including Systematized Nomenclature of Medicine

ITCS 407 Practical Healthcare Management 3 (3 – 0 – 6)

Courses must come first : ITCS 403

Students to learn together : None

		Practicing and applying knowledge on healthcare systems. Visiting and observing healthcare places such as hospitals, health units and health institutes. Studying various healthcare systems for analyzing the requirements of users such as physicians, nurses, health officers and patients. Design and prototype implementation of healthcare related software and system. Management, development and distribution of healthcare related knowledge.	
ITCS	409	Special Topics in Healthcare System Courses must come first : ITCS 403 Students to learn together : None Recent advanced knowledge and techniques in healthcare systems. Knowledge management. Dimensions, factors and significant components in learning regarding the issues of health service systems. IT in knowledge management. Practical deployment of IT in healthcare systems. Other related topics that can be varied depending on interests of faculties and students.	3 (3 – 0 – 6)
ITCS	412	Distributed Database Systems Courses must come first : ITCS 241 Students to learn together : None Components of distributed databases. Distributed database management system. Levels of data distribution. Distributed database design. Distributed data storage. Directory systems. Deadlock detection and prevention. Synchronization. Query optimization and fault tolerance. Distributed query processing and query languages for distributed databases. Distributed transaction model. Concurrency control. Distributed database administration.	3 (3 – 0 – 6)
ITCS	413	Database Design Courses must come first : ITCS 241 Students to learn together : None Relational theory, data semantics and physical design. Storage and file structures. Indexed files. Hashed files. Signature files. B-trees. Performance tuning and database efficiency such as buffering and prefetching. Query	3 (3 – 0 – 6)

processing algorithms and optimization. Design of crash recovery and concurrency control systems.

ITCS 422 Local Area Networks 3 (3 – 0 – 6)

Courses must come first : ITCS 420

Students to learn together : None

Architecture, components, and connection models of local area networks. Standards of local area networks. Cable types used in local area networks. Accessing techniques. Accessing contention and token usage. Local area network protocols. Fiber channel and network backup. Local area network connection and interfaces. Components and types of virtual local area networks. Local area networks within an organization. Tools for designing and solving problems in local area networks. Benefits of applications in local area networks.

ITCS 423 Telecommunication 3 (3 – 0 – 6)

Courses must come first : ITCS 420

Students to learn together : None

Basic principles of telecommunication technology and the telephone network, and the legal, economic, and regulatory environment of the telecommunication industry. Role of new technologies such as microwaves, integrated services digital networks (ISDN), computer communications, and cable television. Common carrier laws and the economics of natural monopoly as the basis for regulations of the telecommunication industry. Issues of competition, monopoly and technical standards. Spectrum allocation and management. International communications and trans-border data flow. Changes in the new technologies and the impact on regulations.

ITCS 425 Algorithms 3 (3 – 0 – 6)

Courses must come first : ITCS 231

Students to learn together : None

Advanced data structures. Combinatory and countable discrete structures. String matching algorithms. Backtracking. Spanning tree algorithm. Graph traversal. Graph algorithms. Greedy algorithm. Dynamic programming. Computational geometry.

ITCS	427	<p>Broadband Network</p> <p>Courses must come first : ITCS 420</p> <p>Students to learn together : None</p> <p>Broadband networks. Components of broadband networks. Connection control and network level management. Broadband network infrastructures include MPLS (Multiprotocol Label Switching), Virtual Private Network layer 3, Broadband network gateways, Broadband remote access servers, and DSLAM (Digital Subscriber Line Access Multiplexer) architecture. IP address management. Security in broadband networks. Wireless broadband networks. Traffic characterization. Access control in broadband networks. Effective capacity. Feedback congestion control. Traffic performance and management.</p>	3 (3 – 0 – 6)
ITCS	428	<p>Network Programming</p> <p>Courses must come first : ITCS 420</p> <p>Students to learn together : None</p> <p>Concepts of remote procedure calls. Network programming to communicate between clients and servers using sockets via TCP and UDP protocols. IP address and machine naming. Secure writing of network programs. Electronic mail sending and receiving. Java network programming concepts such as remote method invocation (RMI), and Microsoft winsocks.</p>	3 (3 – 0 – 6)
ITCS	429	<p>Computer Forensics</p> <p>Courses must come first : ITCS 420</p> <p>Students to learn together : None</p> <p>Principles of computer forensics. Ethics and Laws related to computer forensics. Forensic methodology and process. Data acquisition. Hard disk forensics. Forensic software tools. Investigating Windows and Linux</p>	3 (3 – 0 – 6)

		machines. Network forensic. Email and Internet forensics. Live evidence collection on Windows and Linux. Incident response.	
ITCS	431	Software Design and Development Courses must come first : ITCS 371 Students to learn together : None Principles of software design and software architecture. Methodologies and techniques of designing software system architecture. Requirement analysis of software design. Design patterns. Efficiency factor analysis of software design. Software evolution.	3 (3 – 0 – 6)
ITCS	432	Component-Based Computing Courses must come first : ITCS 371 Students to learn together : None Definition of components. Applications and parts of components. Benefits of components. Architecture of component-based systems. Component design and assembly. Component-oriented software engineering. Processing and modeling of component-based system development. Object-oriented programming and component-based programming. Tools and languages used in developing component-based systems. Event handling.	3 (3 – 0 – 6)
ITCS	433	Production, Supply Chain and Logistics Management Courses must come first : ITCS 335 Students to learn together : None The philosophy and tools of production management strategies, emerging management concepts such as lean production and total quality management, production analysis and planning, control of production systems, customer service and order processing, Inventory planning, warehouse management system, inventory availability, inventory turnover, inventory forecasting, inventory replenishment, efficient order quantities, supply chain engineering, supply chain scoreboard, procurement analysis, supplier partnerships, efficient logistics, efficient transportation planning, shipment planning, mode and carrier selections, order picking systems, shipping and packaging.	3 (3 – 0 – 6)
ITCS	435	Business Decision Analysis Courses must come first : ITCS 125; ITCS 335; ITCS 241	3 (3 – 0 – 6)

Students to learn together : None

Bidding problems. Influence problems. Role of the decision analysis cycle and model sequencing. Assessing the quality of decisions. Framing decisions. Decision hierarchy. Strategies for alternative development. Decision diagrams. Biases in assessment. Developing and using evocative and assessed knowledge maps. Interpretation of sensitivity analysis. Use of approximations. Values of joint information, options, flexibility, bidding, corporate risk attitude, risk sharing and allocation. Decisions involving health and safety.

ITCS	437	<p>Project Management and Practice</p> <p>Courses must come first : ITCS 371</p> <p>Students to learn together : None</p> <p>Project planning. Project management tools. Managing the system life cycle. Cost estimation and project scheduling. Human resource management. Factors influencing productivity and success. Productivity metrics. Key performance index for project efficiency and effectiveness. Project evaluation. Determining skill requirements and staffing of the project. Cost-effectiveness analysis. Reporting and presentation techniques. Effective management in both behavioral and technical aspects. Change management and planning. Option analysis and risks. Release and configuration management. Development of software projects. Software contracts and intellectual property. Case studies of real industrial projects.</p>	3 (3 – 0 – 6)
ITCS	438	<p>E-Business Modeling and Development</p> <p>Courses must come first : ITCS 335</p> <p>Students to learn together : None</p> <p>Core business processes and organizational structures that enable industrial and service enterprises to an e-business model. Identification and deployment of appropriate technologies to elements of E-business. Motivation to drive business actions to the marketplace, supply chains and lifestyles of e-world. Development of various e-business models. Financial operations to support the development of e-business.</p>	3 (3 – 0 – 6)
ITCS	439	<p>E-Customer Relationship Management</p>	3 (3 – 0 – 6)

Courses must come first : ITCS 335

Students to learn together : None

Concepts of customer relationship management. Critical success factors in business development and customer-supplier retention in the context of business-to-business marketing. Transparency and speed of the Internet that add opportunities and threats to customer relationship management. Comparison of the traditional and electronic customer relationship management.

ITCS 440 Principles of Compiler Design 3 (3 – 0 – 6)

Courses must come first : ITCS 221; ITCS 231

Students to learn together : None

Fundamental concepts and history of programming languages. Terminology: Programming language processors and program translators. Compiler and interpreter. Tombstone diagram. Syntactic analysis: Scanning and parsing. Contextual analysis: Identification and type checking. Run-time organization. Code generation. Interpreter and interpretation.

ITCS 445 High Performance Computing 3 (3 – 0 – 6)

Courses must come first : ITCS 343; ITCS 420

Students to learn together : None

Advanced computer architectures in parallel and distributed systems. Processor architecture. Memory systems for high performance computing. Pipelining. Parallel algorithms. Parallel languages. Design, analysis, and implementation of high performance computational science and engineering applications. Scientific data format and visualization. Hardware and software co-design for achieving performance on real-world applications.

ITCS 446 Embedded Systems and Applications 3 (3 – 0 – 6)

Courses must come first : ITCS 343; ITCS 420

Students to learn together : None

Roles of software and hardware in designing embedded systems. Design components including hardware and software architectures, design methodologies and tools, and communication protocols. Design specification and modeling, hardware components and platforms, software organization,



embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems. Advanced topics such as energy management, safety and reliability, and security. Case-studies of real-world systems such as biomedical devices, smart cards, RFID, networked sensors, personal computing devices, home appliances and electronics, and mobile robotics.

ITCS	452	<p>Knowledge-Based Systems <span style="float: right;">3 (3 – 0 – 6)</span></p> <p>Courses must come first : ITCS 241; ITCS 451</p> <p>Students to learn together : None</p> <p>Concepts, components and architecture of knowledge-based systems. Formats, methods, and techniques in explaining knowledge bases. Machine representation of judgmental knowledge and uncertain relationships. Inference on inexact knowledge bases. Rule-based systems principles, advantages, and limitations. Automated planning systems. Knowledge acquisition and explanation producing techniques.</p>
ITCS	453	<p>Data Warehousing and Data Mining <span style="float: right;">3 (3 – 0 – 6)</span></p> <p>Courses must come first : ITCS 241; ITCS 451</p> <p>Students to learn together : None</p> <p>Concepts and components of data warehouses. Architecture of data warehousing system. Data warehousing design and development. OLAP technology. Data mining concepts. Data mining process. Data preparation for data mining. Data mining techniques including market basket analysis, Mining association rules, data classification, data clustering, and data mining applications.</p>
ITCS	455	<p>Natural Language Processing <span style="float: right;">3 (3 – 0 – 6)</span></p> <p>Courses must come first : ITCS 451</p> <p>Students to learn together : None</p> <p>The role of knowledge in language processing, models and algorithms. Languages, thought and understanding. Regular expressions and automata. Morphology and finite-state transducers. N-gram models of syntax. Word classes and part-of-speech tagging. Context-free grammars and parsing. Language complexity. Representing meaning. Semantic analysis. Lexical</p>

semantics and applications such as word-sense ambiguity and information retrieval, dialog and conversational agents. Natural language generation and machine translation.

ITCS	456	<p>Machine Learning and Intelligent Systems</p> <p>Courses must come first : ITCS 451</p> <p>Students to learn together : None</p> <p>Fundamentals of machine learning. Bayes' decision theory. Supervised learning. Learning decision trees. Learning via neural networks. Learning via genetic algorithms. Reinforcement Learning. Unsupervised learning. Clustering. Evaluation and comparison among learning algorithms. Applications of learning techniques for developing intelligent systems.</p>	3 (3 – 0 – 6)
ITCS	457	<p>Decision Support and Business Intelligent Systems</p> <p>Courses must come first : ITCS 241;ITCS 451</p> <p>Students to learn together : None</p> <p>Concepts, components and architecture of decision support and business intelligent systems. Decision theory. Decision models. Database administration for decision support and business intelligent systems. Qualitative and quantitative model implementation. Data warehouses and knowledge management. Design and analysis of business intelligent systems. Tools used to develop business intelligent systems. Cases studies and business applications of decision support systems.</p>	3 (3 – 0 – 6)
ITCS	465	<p>Network Management</p> <p>Courses must come first : ITCS 422</p> <p>Students to learn together : None</p> <p>Network management architectures and applications. Network management standards and models. SNMP (Simple network management protocol) protocol consisting of SMI (Structure of Management Information), ASN.1 (Abstract Syntax Notation One) and MIB (Management Information Base), and SNMP versions. RMON (Remote Monitoring) protocol. Network management functions including configuration, fault, performance, security, and accounting management. Network management tools, systems and</p>	3 (3 – 0 – 6)

		applications. Web-based network management. XML-based network management. Policy- and business-based management.	
ITCS	471	Software Requirement Analysis and Specification	3 (3 – 0 – 6)
		Courses must come first : ITCS 371	
		Students to learn together : None	
		Domain Engineering. Techniques for discovering and elicitation requirements. Languages and models for representing requirements. Analysis and validation techniques including needs, goals, and use case analysis. Requirements in the context of system engineering. Specifying and measuring external qualities: performance, reliability, availability, safety, and security. Specifying and analyzing requirements for various types of systems: embedded systems, consumer systems, web-based systems, business systems, systems for scientists and other engineers. Resolving feature interactions. Requirements documentation standards. Traceability. Human factors. Requirements in the context of agile processes. Requirements management.	
ITCS	472	Software Metrics	3 (3 – 0 – 6)
		Courses must come first : ITCS 371	
		Students to learn together : None	
		Description and definition of software metrics. Theorem of software metrics construction. Software metrics modeling. Efficiency measurement of software products. Efficiency measurement of software process. Software metrics management and usage.	
ITCS	473	Software Quality Assurance and Testing	3 (3 – 0 – 6)
		Courses must come first : ITCS 371	
		Students to learn together : None	
		Software quality assurance process. Avoidance of errors and other quality problems. Inspection and reviews. Testing, verification and validation technique. Process assurance versus Product assurance. Quality process standards. Product and process assurance. Problem analysis and reporting. Statistical approaches to quality control.	

ITCS	476	<p>Digital Image Processing</p> <p>Courses must come first : ITCS 451</p> <p>Students to learn together : None</p> <p>Fundamentals of image processing. Programming and software tools for image processing. Image display. Basic image processing. Image geometry. Image enhancement. Image restoration. Image segmentation. Representation and description. Object recognition. Image compression. Color image processing.</p>	3 (3 – 0 – 6)
ITCS	478	<p>Pattern Recognition</p> <p>Courses must come first : ITCS 451</p> <p>Students to learn together : None</p> <p>Fundamentals of Pattern Recognition; Bayesian Decision Theory; Linear Classifiers; Nonlinear Classifiers; Feature Selection; Feature Generation; Template Matching; Clustering; Pattern Recognition System Evaluation.</p>	3 (3 – 0 – 6)
ITCS	481	<p>Computer Graphics</p> <p>Courses must come first : ITCS 200 ;ITCS 231</p> <p>Students to learn together : None</p> <p>Basic principles for computer graphics. 2D and 3D graphical image synthesis. Principles of displaying objects in 3D. Computation of visualized surfaces. Light and shades. Light and color in image synthesis. Synthesis of surface mapping, shadows, curves, and areas. Writing graphics software on video display interfaces.</p>	3 (3 – 0 – 6)
ITCS	483	<p>Computer Animation</p> <p>Courses must come first : ITCS 481</p> <p>Students to learn together : None</p> <p>Concepts and theories in computer animation. Concepts and theories in lighting and processing. Key-frame animation. Camera animation. Scripting system. Motion capture. Procedural animation. Deformation. Guidelines for presenting through story boards. Applications of 3D program. Object model formation. Object crafting in different granularities. Character animation. Material and surface setting. Surface covering or touching on models. Rendering. Simple scene formation and composite.</p>	3 (3 – 0 – 6)
ITCS	485	<p>Multimedia Information Systems</p>	3 (3 – 0 – 6)

Courses must come first : ITCS 381 and ITCS 371

Students to learn together : None

Definition and basic principles of multimedia systems. Models and standards of multimedia files. Data compression techniques. File storage and transfer over networks. Multimedia systems on web. Voice content based access. Digital sound distribution. Multimedia data retrieval. Distributed multimedia systems. Roles of software companies towards multimedia business. User-oriented interactive TV. Video conferencing. Video on demand. Multimedia software for education and industry. Multimedia archive and electronic library.

ITCS 486 Multimedia Data Technologies 3 (3 – 0 – 6)

Courses must come first : ITCS 381

Students to learn together : None

Sound and audio. Image and graphics. Animation and video. Multimedia standards of audio, music, graphics, image, telephony, video and TV. Capacity planning and performance issues. Input and output devices such as scanners, digital camera, touch screens, voice activated devices, synthesizers, and storage standards including optical disks, CD and DVD. Multimedia servers and file systems. Tools to support multimedia system development.

ITCS 487 Multimedia Authoring and Production 3 (3 – 0 – 6)

Courses must come first : ITCS 381

Students to learn together : None

Concepts and components in designing multimedia systems. Multimedia production. Design fundamentals and design philosophy. 2D animation. 3D animation. Writing storyboard framework. Designing and techniques for 2D animation. Designing and techniques for 3D animation. Audio editing and techniques. Video editing and techniques. Procedures after multimedia production. Development and integration of different multimedia data. Multimedia product evaluation. Media editors. Authoring. Multimedia data streams and structures. Capture. Representation and transformation. Spaces and domains. Data compression and encoding.

ITCS 488 Multimedia Development and Deployment 3 (3 – 0 – 6)

Courses must come first : ITCS 381

Students to learn together : None

Interactive ability of multimedia with users and applications in education, business, industry and entertainment. Software tools used to produce interactive multimedia with users. Main characteristics of software and products. Content-based analysis. multi-modal integration and interfaces. Comparison between single machine-based and Internet-based multimedia. Procedures in multimedia development. Quality of service. Appropriate usage of multimedia.

ITCS 490 Special Topics in Software Engineering 3 (3 – 0 – 6)

Courses must come first : ITCS 371

Students to learn together : None

Recent advanced techniques in software engineering such as software construction, software maintenance, software evolution, software configuration management, software process improvement and other related topics that can be varied depending on interests of faculties and students.

ITCS 491 Senior Project I 3 (3 – 0 – 6)

Courses must come first : The approval of an advisor

Students to learn together : None

Topics of an undergraduate-level project in Information and Communication

Technology with the approval of a senior project advisor.

ITCS 492 Senior Project II 3 (3 – 0 – 6)

Courses must come first : The approval of an advisor

Students to learn together : None

Topics of an undergraduate-level project in Information and Communication

Technology with the approval of a senior project advisor.

ITCS 493 Special Topics in Computer Networks 3 (3 – 0 – 6)

Courses must come first : ITCS 420

Students to learn together : None

Recent advanced techniques in computer network technologies. Special topics in advanced computer networks, security systems and their applications. For examples, next generation networks, new imminent threats and prevention mechanism. Other related topics that can be varied depending on interests of faculties and students.

ITCS	494	<p>Special Topics in Electronic Business</p> <p>Courses must come first : ITCS 335</p> <p>Students to learn together : None</p> <p>Recent advanced techniques in e-business model and technologies. Special topics in advanced e-business systems and their applications. For examples, social networking with e-business, and raising web site ranks via search engine optimization. Other related topics that can be varied depending on interests of faculties and students.</p>	3 (3 – 0 – 6)
ITCS	495	<p>Special Topics in Databases and Intelligent Systems</p> <p>Courses must come first : ITCS 241: ITCS 451</p> <p>Students to learn together : None</p> <p>Recent advanced techniques in database design and its applications. Modern techniques in Intelligent Systems. Other related topics that can be varied depending on interests of faculties and students.</p>	3 (3 – 0 – 6)
ITCS	496	<p>Special Topics in Multimedia Systems</p> <p>Courses must come first : ITCS 381</p> <p>Students to learn together : None</p> <p>Recent advanced techniques in multimedia data management and multimedia technologies. Interesting topics of multimedia applications such as e-learning and information visualization. Other related topics that can be varied depending on interests of faculties and students.</p>	3 (3 – 0 – 6)
ITCS	498	<p>Special Topics in Computer Science</p> <p>Courses must come first : ITCS 231</p> <p>Students to learn together : None</p> <p>Special topics in computer science such as novel algorithms, security and privacy in new applications, high performance computing, novel computing model and new technology in computer science. Other related topics that can be varied depending on interests of faculties and students.</p>	3 (3 – 0 – 6)

### Elective Courses

			Credits (Lecture-Lab)
ITCS	159	Software Lab for Basic Scientific Problem Solving	3 (3 – 0 – 6)

Courses must come first : None

Students to learn together : None

Introduction to problem solving skills using software tools. Software tools for Mathematics and numerical computation. Software tools for graphics and visualization presentation. Database software tools for handling scientific data. Examples of scientific software applications.

ITID 274 Basic Accounting 3 (3 – 0 – 6)

Courses must come first : None

Students to learn together : None

Accounting theory. Principles and practices for obtaining earnings statement, statement of financial and statement of cash flows. Measurement, evaluation and reporting of assets and their effect on earnings determination. Measurement, evaluation and reporting of liabilities. Stockholders equity and their effect on earnings determination. Leases, pensions and other employee retirement benefits, deferred income taxes and earnings per share. International differences in accounting.

ITID 275 Economics 2 (2 – 0 – 4)

Courses must come first : None

Students to learn together : None

Concept and assumptions of economics. Consumers and demands. Producers and supplies. Producing factors. Costs. Losing opportunity. Analysis of demands and supplies. Ways to cut costs and increase maximum profit. Concept of marketing. Business Competition and market structure. Pricing strategy. Floating prices. Oil price. Monopoly. Business transaction for marketing. Business cycle. Fiscal policy. Income tax. Value added tax. Local tax. Monetary policy. Interest rates. Inflation and deflation. Pricing index. Capital market. Saving options. Dividend. Profit speculation. **Gross domestic product**. Economic growth. Income distribution. Financial and banking system. Trade and investment between countries. Exchange rates. Effects of currency appreciation and depreciation. Local economics. Household account. Saving plan. Personal account and spending plan. Analysis of daily situation and decision.

ITID 276 Management 2 (2 – 0 – 4)



		Courses must come first : None	
		Students to learn together : None	
		Basic management principles and skills. Resource and time management. Teams and Groups. Quality in the team. Delegation. Managing people. Oral communication and Presentation skills. Project planning.	
ITID	277	Digital Marketing	2 (2 – 0 – 4)
		Courses must come first : None	
		Students to learn together : None	
		Product management. Product definition and differences. Product brand. Up-market and Down-market. Mass and Niche market. Product Life Cycle. Price Management. Price Strategies. Determinants of Price. Communication management. Advertising. Promotional Tools. Sponsorships TV advertising. Product placement. Street-level promotion Celebrity endorsement. Communication tools. Sales promotion. Public Relation. Product distribution. Wholesaler. Retailer. Electronic commerce. Ethics in marketing and advertising. Applications of IT for marketing.	
ITCS	363	Information Systems in Organization	3 (3 – 0 – 6)
		Courses must come first : ITCS 200	
		Students to learn together : None	
		Management information systems. Information systems to organization objectives. Organization structure and management. Representation and analysis of system structure. Systems information and decision theory. Information system applications. System selection and evaluation.	
ITCS	376	Advanced Mathematics II for Computer Science	(3 – 0 – 6)
		Courses must come first : ITCS 375	
		Students to learn together : None	
		Functions of several variables. Partial derivatives. Cylindrical and spherical coordinates. Complex variables. Ordinary differential equations of first and second order. Linear and non-linear first order differential equations. Second order and higher order differential equations. Applications of differential equations.	
ITCS	391	Computer Network Lab	1 (0 – 2 – 1)
		Courses must come first : ITCS 420	

Students to learn together : None

Practices in applying a variety of techniques and tools for setting up and testing a computer network. Network components and installation. Network configuration. Router and Switch configuration. IP address allocation. Domain name server installation and services. Network commands on Windows and Linux operating systems. Email installation and configuration. Wireless network installation. Traffic capture and analysis. Software usage for network security. Adoption of new network technologies according to the interest of faculties and students.

ITCS 392 Multimedia Systems Lab 1 (0 – 2 – 1)

Courses must come first : ITCS 381

Students to learn together : None

Practices on applying a variety of techniques for developing multimedia systems. Development of web interfaces. 2D image creation. Putting special effects on 2D images. Adaptation and scaling for web graphics. Published media and video. Image processing software. Audio and video encoding. Writing software for creating animation. Adoption of new technology in multimedia system and the interest of faculties and students.

ITCS 393 Database Systems Lab 1 (0 – 2 – 1)

Courses must come first : ITCS 241

Students to learn together : None

Practices on applying the database management techniques to solve real problems including performance tuning of database systems, query optimization, indexing of database systems, and operations of database system components. Efficient design of large database systems. Data model usage.

ITCS 398 Cooperative Education 3 (0 – 6 – 3)

Courses must come first : The approval of an advisor

Students to learn together : None

Practice at government agency or private company having ICT department and working on the topic for cooperative education in Information and

Communication Technology with the approval of an advisor, and having the duration of practice of at least 1 semester.

ITCS 399 Internship 3 (0 – 6 – 3)

Courses must come first : The approval of an advisor

Students to learn together : None

Internship at government agency or private company having ICT department and working on the topic in Information and Communication Technology with the approval of an advisor.

ITCS 497 Independent Study 3 (0 – 6 – 3)

Courses must come first : The approval of an advisor

Students to learn together : None

In-depth study of specific topics in Information and Communication Technology that a student selects in consultation with and completed under the supervision of an instructor.