

Bachelor of Science Program in Computer Science (International Program)

Degree Plan

Regular Track and Cooperative and Work Integrated Education Track

Total Number of Credits

General Education	24 credits
English Languages	9 credits
Integrated Professional Skills Course	15 credits
Professional Education	99 credits
Core Courses	18 credits
Major Requirements	54 credits
Major Electives	27 credits
Free Electives	6 credits
Total	<u>129</u> credits

List of Courses

1. General Education	(24 Credits)
<u>English Languages</u>	(9 Credits)
	Credits (Lecture–Training–Self-Study)
IEN106 The Art of Writing	3 (2 – 2 – 6)
IEN107 Critical Reading and Writing	3 (2 – 2 – 6)
IEN108 Persuasive Presentation	3 (2 – 2 – 6)
<u>Integrated Professional Skills Course</u>	(15 Credits)
	Credits (Lecture–Training–Self-Study)
IGE011 Thinking Skills for Lifelong Learning	3 (3 – 0 – 6)
IGE012 Citizenship in Society and International Community	3 (3 – 0 – 6)
IGE013 Technology and Innovation for the Future	3 (3 – 0 – 6)
IGE014 Aesthetics and Well-being for Life	3 (3 – 0 – 6)
IGE015 Entrepreneurial Spirit and Financial Literacy	3 (3 – 0 – 6)
2. Professional Education	(99 credits)
<u>Core Courses</u>	(18 credits)
	Credits (Lecture–Training–Self-Study)
ICS100 Foundations of Computer Science I	3 (2 – 2 – 5)
ICS101 Computing Logic	3 (2 – 2 – 5)
ICS102 Fundamental of Computer Programming	3 (2 – 2 – 5)
ICS103 Data and Database System	3 (2 – 2 – 5)
ICS104 Technology Entrepreneurship	3 (3 – 0 – 6)
ICS105 Law and Professional Ethics in Computing	3 (3 – 0 – 6)

Major Requirements**(45 credits)**

Credits (Lecture–Training–Self-Study)

ICS201	Foundations of Computer Science II	3 (2 – 2 – 5)
ICS202	Data Structures and Algorithms	3 (2 – 2 – 5)
ICS203	Software Engineering and Object-Oriented Programming	3 (2 – 2 – 5)
ICS204	Computer Networking Security	3 (2 – 2 – 5)
ICS205	Operating System	3 (2 – 2 – 5)
ICS206	Cloud Computing	3 (2 – 2 – 5)
ICS207	Artificial Intelligence and Machine Learning	3 (2 – 2 – 5)
ICS208	Further Programming Paradigms	3 (2 – 2 – 5)
ICS301	Data and Internet Networking	3 (2 – 2 – 5)
ICS302	Distributed System	3 (2 – 2 – 5)
ICS303	Software Engineering and Coding Practices	3 (2 – 2 – 5)
ICS304	Business Analytics with Data Visualization	3 (2 – 2 – 5)
ICS305	Deep Learning and Advanced Artificial Intelligence	3 (2 – 2 – 5)
ICS401	Ethical Hacking and Pentesting	3 (2 – 2 – 5)
ICS402	Information Security Management	3 (2 – 2 – 5)
ICS403	Information System Analysis and Design	3 (2 – 2 – 5)
ICS404	Capstone Project I	3 (2 – 2 – 5)
ICS405	Capstone Project II	3 (2 – 2 – 5)

Major Electives**(27 credits)**

Students select only 27 credits from the following courses.

Cybersecurity and Information Assurance

Credits (Lecture–Training–Self-Study)

ICS310	Blockchain and Cryptography Technology	3 (2 – 2 – 5)
ICS311	Cybersecurity	3 (2 – 2 – 5)
ICS312	Computer Security	3 (2 – 2 – 5)
ICS313	Wireless and Mobile Networks	3 (2 – 2 – 5)
ICS314	Network Design and Management	3 (2 – 2 – 5)
ICS315	Computer Hacking Forensic	3 (2 – 2 – 5)
ICS410	Risk Assessment and Contingency Planning	3 (2 – 2 – 5)
ICS411	Incident Response Management	3 (2 – 2 – 5)
ICS412	Secure Software Design	3 (2 – 2 – 5)
ICS413	Cloud Systems Security	3 (2 – 2 – 5)

Data Science and Data Analytics

Credits (Lecture–Training–Self-Study)

ICS316	Introduction to Data Science	3 (2 – 2 – 5)
ICS317	Big Data Analytics for Business	3 (2 – 2 – 5)
ICS318	Data Engineering and Implementation	3 (2 – 2 – 5)
ICS319	Data Warehousing	3 (2 – 2 – 5)
ICS320	Text Analytics	3 (2 – 2 – 5)
ICS414	Text Processing	3 (2 – 2 – 5)
ICS415	Data Visualization	3 (2 – 2 – 5)
ICS416	Data Analytics with R	3 (2 – 2 – 5)
ICS417	Big Data Management	3 (2 – 2 – 5)
ICS418	Data-driven Communication and Storytelling	3 (2 – 2 – 5)

Computing Science and Business Innovation

Credits (Lecture–Training–Self-Study)

ICS321	Introduction to Business Process Management	3 (2 – 2 – 5)
ICS322	Introduction to Business Computing	3 (2 – 2 – 5)
ICS323	Computer Organization and Architecture	3 (2 – 2 – 5)
ICS324	Compiler Construction	3 (2 – 2 – 5)
ICS325	Integrated Digital Marketing	3 (2 – 2 – 5)
ICS419	Information Systems for Management	3 (2 – 2 – 5)
ICS420	Computer Applications in Business	3 (2 – 2 – 5)
ICS421	Enterprise Application Development	3 (2 – 2 – 5)
ICS422	Internet of Things and Applications	3 (2 – 2 – 5)
ICS423	Introduction to Business Intelligence System	3 (2 – 2 – 5)
ICS424	Practical Digital Marketing	3 (2 – 2 – 5)
ICS425	Digital Business Transformation	3 (2 – 2 – 5)
ICS426	Electronic Business	3 (2 – 2 – 5)

Artificial Intelligence and Machine Learning

Credits (Lecture–Training–Self-Study)

ICS326	Machine Learning and Implementation	3 (2 – 2 – 5)
ICS327	Deep Learning	3 (2 – 2 – 5)
ICS328	Natural Language Processing	3 (2 – 2 – 5)
ICS329	Data Mining and Predictive Analytics	3 (2 – 2 – 5)
ICS340	Intelligent Systems Design and Applications	3 (2 – 2 – 5)
ICS427	Ethical and Responsible Artificial Intelligence	3 (2 – 2 – 5)
ICS428	Generative Artificial Intelligence and Large Language Models	3 (2 – 2 – 5)
ICS429	Artificial Intelligence for Robotics and Autonomous Systems	3 (2 – 2 – 5)
ICS430	Cloud-based Artificial Intelligence and Data Analytics	3 (2 – 2 – 5)
ICS431	Artificial Intelligence Capstone Project	3 (2 – 2 – 5)

IGE012 Citizenship in Society and International Community 3 (3 – 0 – 6)

Concepts, traits, rights, duties and responsibilities of citizenship in Thai society, global society, and digital society, with ability to adjust and live happily with others while keeping abreast of and adapting themselves to societal changes which may affect livelihood and working life; awareness and cooperation at different levels among people of diverse cultures.

IGE013 Technology and Innovation for the Future 3 (3 – 0 – 6)

Concepts, roles, awareness, and adjustment to changes of the future and applications of various types of technology and innovation in knowledge acquisition and improvement of quality of life in a new normal society including ways to solve life complexity and challenges, and to enhance creative working life; impacts of technology and innovation on our livelihood, society and economics, and how to optimize and to protect the intellectual property arising from technology and innovation.

IGE014 Aesthetics and Well-being for Life 3 (3 – 0 – 6)

How to live a meaningful life through various types of arts, recreational activities and sports; new perspectives for aesthetics of life that influence one's mind and how one may plan a path to success from one's passion.

IGE015 Entrepreneurial Spirit and Financial Literacy 3 (3 – 0 – 6)

The development of character traits that are vital to cultivating an entrepreneurial spirit, with an emphasis placed on how to think like an entrepreneur, opportunities to start and run a business with on the basis of ethics and moral grounds, how to effectively manage and make financial decisions, personal financial management and investment, including sustainable development, effective leadership skills development, teamwork, bold, prompt and well-informed decisions-making.

2. Professional Education (93 credits)**Core Courses (18 credits)****ICS100 Foundations of Computer Science I 3 (2 – 2 – 5)**

Fundamental mathematics for computer science, Sets, Relations, Functions, Graphs, Sequences, Series, Matrices, Determinants, Systems of linear equations, Vectors, introductory vector spaces, applying linear algebra, Basic mathematical structures, solving linear systems and constructing linear models.

ICS101 Computing Logic 3 (2 – 2 – 5)

Basic knowledge of computer science, software, hardware, platforms, and modern technologies for application development. Computational thinking, Logical thinking, Analytical problem-solving, Basic principles of designing and developing programs, Developing no-code technology, Data representation.

ICS102 Fundamental of Computer Programming**3 (2 – 2 – 5)**

Fundamentals of computer programming concept, using high-level programming language, Data types, Variables, Expression, Control statements, String processing, Arrays, Files, Functions, Testing, Error handling.

ICS103 Data and Database System**3 (2 – 2 – 5)**

Fundamental concept and architecture of database systems, Database management systems, Types of databases, Data models, Entity relationship model, Functional dependencies; Normalization, Query languages and Transaction management.

ICS104 Technology Entrepreneurship**3 (3 – 0 – 6)**

Concept of entrepreneurship, Knowledge and skill of information technology for business operations, Finding new business opportunities, Writing business plan, Analysis feasibility of business, Risk management, Problems and barriers of new businesses, Role of both the public and private sectors toward business development, Adapting future the trend of economic change, Business Model Canvas (BMC), Value Proposition Canvas (VPC), Marketing strategy, Business pitching macroeconomic factors.

ICS105 Law and Professional Ethics in Computing**3 (3 – 0 – 6)**

International principles of ethics, Ethics of information technologist, Ethics of artificial intelligence usage, Laws of computer and information technology, Computer crime act, Personal data protection act, electronic transaction act, Software licensing, Intellectual property.

Major Requirements (54 credits)**ICS201 Foundations of Computer Science II****3 (2 – 2 – 5)**

Statistics and mathematic for Artificial Intelligence, Types of Statistic, Statistical methodology, Data pre-processing, Learning techniques, Supervised learning, Unsupervised learning, Classification, Clustering, Regression, Model evaluation and application.

ICS202 Data Structures and Algorithms**3 (2 – 2 – 5)**

Basic data structures, Circular lists, Double-linked lists, Stacks, Queues, Trees, Graphs, Data searching, Data sorting, Hash tables, Methods of preventing data collisions, Binary search trees, Applying graph to data structures, Finding the shortest path, Advanced data sorting, Searching techniques, Recursion, Basic algorithm analysis principles, Complex algorithm.

ICS203 Software Engineering and Object-Oriented Programming 3 (2 – 2 – 5)

Theory and concept of object-oriented programming, Classes, Abstract data types, Object relationship models, Inheritance, Encapsulation, Information hiding, Polymorphism, Arrays, reusing software component, Creating and managing dynamic data structures, Designing and developing object-oriented programs object-oriented languages and frameworks.

ICS204 Computer Networking Security 3 (2 – 2 – 5)

Concepts and fundamentals of computer networking security, security objectives and principles in networked environments, network architectures and communication protocols, network threats, vulnerabilities, and risk factors, security mechanisms for wired and wireless networks, access control and authentication in networks, network traffic monitoring and intrusion detection, firewall and network defense technologies, secure network configuration and management, data protection during network transmission, incident response and recovery in network security, network security policies and best practices.

ICS205 Operating System 3 (2 – 2 – 5)

Operating-system structures, Process management, CPU scheduling, Process synchronization, Deadlocks, Memory management, Virtual memory, File system, I/O systems, Secondary storage structure, Swap-space management and Virtualization.

ICS206 Cloud Computing 3 (2 – 2 – 5)

Concepts and principles of cloud computing architecture, cloud creation and components, Services on cloud computing platforms, Software as a service (SaaS), Platform as a service (PaaS), Infrastructure as a service (IaaS), Data storage services, Leveraging cloud computing, Basic cloud security, Basic tools and technologies for cloud design.

ICS207 Artificial Intelligence and Machine Learning 3 (2 – 2 – 5)

Machine learning models, Machine learning applications, Supervised and unsupervised machine learning, Integrating generative Artificial Intelligence, Types, Applications, Case studies, Problems, Impact and Prompt engineering.

ICS208 Further Programming Paradigms 3 (2 – 2 – 5)

Principles of programming languages, Syntax, Semantics. Design and structure of major computer programming language paradigms, Structural languages, Object-oriented languages, functional languages, Logic and rule-based languages, Comparisons of different paradigms, Language features.

ICS301 Data and Internet Networking**3 (2 – 2 – 5)**

Foundation of computer networks, Network topologies, Network protocols, Methods and best practices of computer network for communication, Physical components of communication networks, Architecture, the use of computer networks to enable communication, Physical and architectural elements, Information layers of a communication network, Diagnostic tools, Designing, operating, Measuring, adjusting networks, Comparing the differences in various network architectures.

ICS302 Distributed System**3 (2 – 2 – 5)**

Transaction management, Indexing, Recovery techniques, Concurrency control techniques, Transaction failure recovery, Deadlock handling, Query processing, Query optimization, Distributed database, Database tuning.

ICS303 Software Engineering and Coding Practices**3 (2 – 2 – 5)**

Principles of software engineering, Software Processes, Requirement analysis and management, System modeling, Architectural Design, Software Evolution, Software Validation, Software Verification, Software deliverable standards, best practices in Software engineering, Computer-Aided Software Engineering (CASE) Tools.

ICS304 Business Analytics with Data Visualization**3 (2 – 2 – 5)**

Concepts and theories in managing and analyzing data, Extracting significant data patterns, Supporting organizational decision-making, Machine learning, Data preparation steps for analysis, Data classification, Data grouping, Model performance evaluation, Data visualization, Utilizing tools, Analysing, Applying applications in business contexts.

ICS305 Deep Learning and Advanced Artificial Intelligence**3 (2 – 2 – 5)**

Introduction to machine learning, statistical pattern recognition, learning theories, Supervised learning, generative learning, discriminative learning, parametric learning, non-parametric learning, artificial neural networks, supporting vector machines. Unsupervised learning, Clustering, Dimensionality reduction, kernel methods, Discussion of the applications of machine learning, Robotic control, Data mining, Autonomous navigation, Bioinformatics, Speech recognition, Text processing, Web data processing.

ICS401 Ethical Hacking and Pentesting**3 (2 – 2 – 5)**

Ethical hacking, Penetration testing, Planning, Reconnaissance, Scanning, Post-exploitation hacking, Reporting results. Vulnerability, Solutions mitigate the risk of attack, Intrusion detection, exploiting any vulnerability in the target network environment, avoiding hacking, preventing hacking, understanding protection approaches computer network attacking.

ICS402 Information Security Management **3 (2 – 2 – 5)**
 Concepts and principles of computer network security, Infrastructure, Devices within the network, firewalls. Data encryption techniques, Digital signatures, IP Security, Intrusion detection systems, Prevention methods. Network system design, Security considerations.

ICS403 Information System Analysis and Design **3 (2 – 2 – 5)**
 Types of Information System (IS), System alternatives, Systems Development of Life Cycle (SDLC), Defining logical system requirements, System development techniques and tools, modelling, prototyping. System design, System implementation, System operation, Support, Maintenance.

ICS404 Capstone Project I **3 (2 – 2 – 5)**
 Designing and planning of an integrative computing project applying accumulated knowledge, technical skills, Professional competencies. Identifying and define real-world computing problems. Software engineering, Artificial intelligence, Data science, Cybersecurity, Cloud computing, or Digital systems.

ICS405 Capstone Project II **3 (2 – 2 – 5)**
 Development, testing, and evaluation of computing projects, software systems, AI models, data-driven applications, computing solutions. Software development processes, System testing, Performance optimization, Real-world deployment. Producing technical documentation, Practical applicability in industry.

Major Electives **(27 credits)**

Students select only 27 credits from the following courses.

Cybersecurity and Information Assurance

ICS310 Blockchain and Cryptography Technology **3 (2 – 2 – 5)**
 Foundations of blockchain technology from multiple perspectives, Key concepts, Developments around cryptocurrencies, Distributed ledger systems, Basic components of a blockchain, Operations underlying algorithms. Hashing, Cryptography foundations, post-quantum cryptography.

ICS311 Cybersecurity **3 (2 – 2 – 5)**
 Fundamental concepts and scope of cybersecurity, cybersecurity objectives and threat landscape, cyber risks, vulnerabilities, and attack vectors, principles of information security and risk management, network and cloud security fundamentals, web and application security basics, data protection and privacy, identity and access management, security monitoring and incident response, cybersecurity governance, policies, and compliance, ethical, legal, and professional issues in

cybersecurity, cybersecurity best practices for individuals and organizations; case studies and analysis of cybersecurity incidents.

ICS312 Computer Security **3 (2 – 2 – 5)**

Fundamental concepts and principles of computer security, security objectives and threat landscape, common security risks, vulnerabilities, and attack types. security models, policies, and access control mechanisms, authentication and authorization techniques, cryptography fundamentals and secure data protection, operating system and application security, malware and malicious software analysis, software and system vulnerabilities; basic network and endpoint security; security monitoring, incident response, and recovery.

ICS313 Wireless and Mobile Networks **3 (2 – 2 – 5)**

Wireless networks, Mobility in wireless networks, Protocols in wireless and mobile networks, Location management, Quality of service in wireless networks, Application in wireless and mobile networks, distributed applications, middleware, mobile transactions, mobile multimedia, Remote execution.

ICS314 Network Design and Management **3 (2 – 2 – 5)**

Basic concepts in networks, Modeling and evaluation techniques, Network analysis in delay, loss and throughput, Centralized network design. Distributed network design, network reliability, Applications to local area wireless, wide area, multi-service networking. Network management, SNMP, OSI management, distributed network management and architectures.

ICS315 Computer Hacking Forensic **3 (2 – 2 – 5)**

Concepts and principles of hacking. Comprehensive forensic science processes for legal aspects, file systems, operating systems, network, database forensics, websites, email systems. Techniques for cloud forensic auditing, malware, and mobile devices, accessing data, analyzing data, concealing evidence in forensic science. Understanding the protection-evidence chain, legal forensic science reports, presentation techniques.

ICS410 Risk Assessment and Contingency Planning **3 (2 – 2 – 5)**

Overview of fundamental considerations, processes, preparing organizations for disruptions of information technology infrastructures and operations. Framework of information technology of risk management, Design, Implement, test contingency plans, business impact analyses, business continuity plans, disaster recovery plans.

ICS411 Incident Response Management **3 (2 – 2 – 5)**

Response management, Digital forensics. Skills, Knowledge needed to formal investigations, manage, Incident response to system breaches, advanced persistent threats, anti-forensic practices. Skills needed for collecting, Analyzing data for several Operating Systems.

ICS412 Secure Software Design**3 (2 – 2 – 5)**

Processes and procedures for developing secure software systems and vulnerabilities found in software applications. A holistic approach to application security. Technical of vulnerabilities found in software, procedures for mitigating, vulnerabilities, general procedures to software design, a secure software design.

ICS413 Cloud Systems Security**3 (2 – 2 – 5)**

Cybersecurity, Basic cloud-based information technology infrastructure, architecture, design requirements of cloud system, security issues, platform, applications. Reviewing cloud operation, legal issues, compliance practices.

Data Science and Data Analytics**ICS316 Introduction to Data Science****3 (2 – 2 – 5)**

Concepts and principles of data science, Data preparation, Data cleaning, Exploratory data analysis, Predictive analysis, Prescriptive analysis, Conditional analysis formats. Challenges in data science, Basic data science tool usage, applying statistics to data science, Using machine learning for data analysis.

ICS317 Big Data Analytics for Business**3 (2 – 2 – 5)**

Concepts of big data management, Sizing analysis. Distributed computing, Technologies for managing big data, big data for machine learning, Theory of social network analysis, Tools for social network analysis, Tool for business analysis. Case studies of big data analytics and applications for business, big data security analytics.

ICS318 Data Engineering and Implementation**3 (2 – 2 – 5)**

Principles of data engineering. Concept of data security, Data engineering lifecycle, Data engineering technologies, Relational database, Unstructured data, big data, Data engineering programming, Python, Structure Query Language.

ICS319 Data Warehousing**3 (2 – 2 – 5)**

Theory and concepts of Data warehousing, Characteristics of data warehousing, Drawbacks of data warehousing, Architecture of data warehousing, Design issues of the data warehousing, Internal data structure for the data warehousing, Data integration, Complexity and techniques, Creating high quality data, Data mart, Data Mining, Data Web housing, Web mining.

ICS320 Text Analytics**3 (2 – 2 – 5)**

The concepts on textual data collection, Principle of corpora creation, Textual data normalization, Statistical and machine learning concepts for modeling the information in textual corpora. Application of sentiment analysis, Opinion mining. Document classification, Automatic text summarization.

ICS414 Text Processing**3 (2 – 2 – 5)**

Basic concepts and theories in the processing of natural language text. Exploring tools for the automated processing of text in corpora. Fundamental text preprocessing tasks, Tokenization, Stopword removal, Stemming, Lemmatization. Fundamental concepts on text processing systems, Information retrieval, Sentiment analysis, Opinion mining, Automatic text summarization systems.

ICS415 Data Visualization**3 (2 – 2 – 5)**

Ideas and principles of data presentation through diagrams. Designing data presentation with diagrams, Tools for data presentation, Diagrams, Data preparation, Line graphs, Scatter plots, Bar charts, Pie charts, Tree diagrams, Network Diagrams, Stream graphs, Key performance indicator (KPI) charts, Maps, Relational diagrams, Explaining Diagrams.

ICS416 Data Analytics with R**3 (2 – 2 – 5)**

The basics of programming with R and application of R programming in the area of statistical issues and Data Science. Data structures in R, Functions, Control flow, Data frame, Packages for Data manipulation, Data visualization by using R graphics.

ICS417 Big Data Management**3 (2 – 2 – 5)**

Concepts of Database, Database Systems, Database Management Systems, Interaction of users in database systems, Relational Database design, Data Model, Database Schema, Functional Dependencies, Normalization, Data Dictionary; Structure Query Language (SQL).

ICS418 Data-driven Communication and Storytelling**3 (2 – 2 – 5)**

Analysing data from various sources, applying visualization techniques to communicate insights. Designing charts, graphs, and interactive dashboards; Evaluating and presenting data, using storytelling technique through data visualization for strategic decision-making and explaining business issues.

Computing Science and Business Innovation

ICS321 Introduction to Business Process Management 3 (2 – 2 – 5)

Introduction to End-to-End process, Business process management, Process improvement, Business process reengineering, Process improvement methodology, Visibility, Accessibility, Performance metrics, Quality assurance, Leveraging technology, Process modeling tools, Business process automation.

ICS322 Introduction to Business Computing 3 (2 – 2 – 5)

Fundamental concepts of computers, Use of operating systems, Application of computers in business, Documentation, Filing, Document, Report generating, Creation of data directories, Data input, Representing data, Outputs, Calculation, Graphs generating.

ICS323 Computer Organization and Architecture 3 (2 – 2 – 5)

Computer systems, Elementary structure, Instruction format, Addressing modes, i/o interrupts, Bus systems, Storage structure, Memory system organization, architecture. Implementation of simple data path, Control unit, Instruction pipelining, Instruction-level parallelism, Cisc and risc architectures, Multiprocessor interconnection.

ICS324 Compiler Construction 3 (2 – 2 – 5)

Grammars, Languages, Syntax, Semantics, Concepts of parsing and ambiguity, Backus-naur form, Regular grammars, recognizers, Lexical scanners, Symbol tables, Parsers, Theory and examples of context-free languages, push-down automata. Context-free parsing techniques, Techniques of machine-independent code generation, improvement.

ICS325 Integrated Digital Marketing 3 (2 – 2 – 5)

Comprehensive view of digital marketing, emphasizing the integration of various online marketing channels for a cohesive strategy. SEO, Social media marketing, Email marketing, Content marketing, Digital analytics, Developing and executing Digital marketing plans.

ICS419 Information Systems for Management 3 (2 – 2 – 5)

Role of information systems in business management. The design, implementation, management of systems for supporting business operations, Decision-making. Database management, Information system strategies, the Integration of technology in business processes.

ICS420 Computer Applications in Business 3 (2 – 2 – 5)

Certain system aspects in business and industry, financial institute, hotel, hospital, trading. Data preparation, Applications of various software packages to selected topics in business and industry, payroll package, inventory control package, financial analysis package. Information System usage in an enterprise, Enterprise Resource Planning, Customer Relation Management system,

Business intelligence system. Commercialization of mobile applications for marketing, advertising, trading.

ICS421 Enterprise Application Development 3 (2 – 2 – 5)

Designing and implementing enterprise applications, web-based enterprise applications, packaging, deploying the application. Application architecture for the modern enterprises, Service-Oriented architecture, Web-service.

ICS422 Internet of Things and Applications 3 (2 – 2 – 5)

Principles and concepts of the Internet of Things, Ideologies, Architectures. Case studies, Platforms in system development, Hardware, Software components. Communication protocols. Embedded programming, Applications of the Internet of Things.

ICS423 Introduction to Business Intelligence System 3 (2 – 2 – 5)

Fundamentals of Business Intelligence systems, Business Intelligence tools, Process, Analyzing business data for decision-making. Data mining, Data Warehousing, Data reporting. Role of Business Intelligence in organizational strategy.

ICS424 Practical Digital Marketing 3 (2 – 2 – 5)

Application of digital marketing theories through real-world scenarios. Searching Engine Optimisation for online advertising, social media campaigns, Web analytics. Creating, managing digital marketing strategies.

ICS425 Digital Business Transformation 3 (2 – 2 – 5)

Impact of digital technology on business, Strategies for digital transformation, Adoption of digital tools, Digitalization of business processes, Driving Business Growth through Digital Innovation.

ICS426 Electronic Business 3 (2 – 2 – 5)

Conducting business online, E-commerce models, Online transaction processing, electronic payment systems, Digital marketing strategies, Legal, Ethics, Security issues in electronic business.

Artificial intelligence and Machine Learning

ICS326 Machine Learning and Implementation 3 (2 – 2 – 5)

The foundational principles of machine learning, Data preparation, Model development, Evaluation techniques, Practical deployment. Technical problem-solving, Deep data analysis, the ability to design and implement machine-learning prototypes.

- ICS327 Deep Learning** **3 (2 – 2 – 5)**
 The principles and architectures of deep learning, Model development, Training, Evaluation for real-world applications. Developing skills in building neural network models, performing Deep Data analysis, Applying deep learning solutions.
- ICS328 Natural Language Processing** **3 (2 – 2 – 5)**
 Processing, Understanding language data, Usage of Natural Language Processing techniques. Building, Analyzing, Evaluating Natural Language Processing models for practical applications, gaining the ability for designing systems, Interpreting, Generating human language.
- ICS329 Data Mining and Predictive Analytics** **3 (2 – 2 – 5)**
 Data mining techniques, Statistical analysis, Predictive model development for supporting technical, Business decision-making. Practice skills in pattern discovery, Predictive modeling, Applying analytical insights.
- ICS340 Intelligent Systems Design and Applications** **3 (2 – 2 – 5)**
 Designing, Developing, Evaluating intelligent systems for autonomous decision-making across applications. Learning problem analysis, Intelligent system to architecture design, prototype development.
- ICS427 Ethical and Responsible Artificial Intelligence** **3 (2 – 2 – 5)**
 Exploring ethical principles, Risk management, Governance in Artificial Intelligence development, deployment. Learning impacts assessment, designing systems, applying Artificial Intelligence to systems.
- ICS428 Generative Artificial Intelligence and Large Language Models** **3 (2 – 2 – 5)**
 The concepts, technologies, applications of Generative Artificial intelligence and Large Language Models. Developing skills in building generative prototypes, analyzing model behavior, evaluating performance and risks.
- ICS429 Artificial Intelligence for Robotics and Autonomous Systems** **3 (2 – 2 – 5)**
 Development on Artificial Intelligence techniques for robotics and autonomous systems, perception, navigation, autonomous decision-making. The build of intelligent robotic prototypes, evaluation of performance in real-world scenarios.
- ICS430 Cloud-based Artificial Intelligence and Data Analytics** **3 (2 – 2 – 5)**
 Exploring the use of cloud platforms for large-scale data processing, artificial intelligence model development, analytical system architecture. Development of skills in cloud-based tools, deep data analytics, designing scalable and solutions.

ICS431 Artificial Intelligence Capstone Project 3 (2 – 2 – 5)

Integration of AI knowledge for designing and developing an innovative solution to prototype in real-world problems. Enhancement of skills in project management, applied research, professional communication of results.

Cooperative Education**ICS432 Pre-Cooperative Education 3 (3 - 0 - 6)**

Concept of Cooperative Education, Improving of Related Skills, Writing a job Application Letter, Sorting Corporation, Interview Techniques, Communication Skills, Personality, and Teamwork, Learning Corporation Culture, Creative Thinking, Report Writing, Presentation Technique, Entrepreneur Skill, Good practice working in Corporation, Security in Corporation.

ICS433 Cooperative Education 6 (0 - 35 - 0)**Prerequisite: Passed ICS432**

Working as corporations' officer, Strengthening readiness in future career path by practicing basic operations, Work evaluation by instructors and corporation, Submission work summary report, Work result presentation at the end of work period.

3. Free Electives (6 credits)

Students must select 6 credits with international courses from other majors as the following courses.

ICS434 Artificial Intelligence Quality Assurance and Model Auditing 3 (2 – 2 – 5)

Evaluating the quality, Reliability of artificial intelligence systems, Model auditing, Risk assessment. Testing model performance, Designing governance frameworks. Practical skills in auditing artificial intelligence models, Document findings, Presenting recommendations, Deployment in real-world applications.

ICS435 Disruptive Technology 3 (2 – 2 – 5)

Innovation-driving technologies, Artificial Intelligence, Robotics, Digital Platforms, Internet of Things, Social media. Strategies for sustainable business growth, transforming traditional products, services, Modern technology for organizational change, adapting to market shifts, evolving consumer behavior, changing technology landscapes.