

COURSE DESCRIPTION

Undergraduate Program in Software Engineering

Course Catalogue (URL):

http://sse.hust.edu.cn/system/\_content/download.jsp?urltype=news.DownloadAttachUrl&owner=1894223007&wbfileid=11379272

Explanation:

1. Minimum curriculum credits for graduation (including courses and practicum)：155.3 Credits.
2. The number of minimum ECTS for graduation in European universities is 240. Therefore, the conversion ratio between Original Credit and ECTS is:

**1 Original Credit corresponding to 1.545 ECTS**

1. For General Education Courses, the course number is not applicable.
2. For the course “Engineering Internship”, there are 3 parts in 3 different semesters. Content of this course varies for different students.

The courses listed below are in the same order as they appear on the official transcript.

2020-2021 1st Semester

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| Name | Advanced Programming Language(C) |
| No. | SSE0601 |
| Credits | 3 |
| Description | This course covers the fundamental concepts of C programming language, such as variables, constants, expressions, program structure and flow control, functions, arrays, pointers, structures and unions, files, etc. Furthermore, it enables students to accumulate practical programming experience, enhance their programming skills, familiarize themselves with development tools, and comprehend the principles of procedural programming. |

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| Name | Advanced Programming Language Experiments |
| No. | SSE0602 |
| Credits | 1 |
| Description | This course complements the “Advanced Programming Language (C)” course. It consists of practical experiments that reinforce the theoretical concepts taught in the lectures. The experiments cover topics such as branching and looping statements, arrays and functions, pointers and structures, linked lists, and integrated experimental design. |

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| Name | Computational Thinking |
| No. | CST5181 |
| Credits | 2 |
| Description | The goal of this course is to develop students’ scientific and engineering thinking - computational thinking. It teaches students how to use computational methods to solve problems in various social and natural domains, and how to apply typical computational thinking to build computational systems. |

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| Name | Military Theory |
| No. | RMWZ0001 |
| Credits | 1 |
| Description | This course introduces ancient Chinese military thinking and international political environment. |

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| Name | Military Training |
| No. | RMWZ3511 |
| Credits | 1 |
| Description | This course mainly focuses on physical training. |

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| Name | Morals, Ethics and Fundamentals of Law |
| No. | MAX0022 |
| Credits | 2.5 |
| Description | This course aims to help students develop correct outlooks on life, values, ethics and law. |

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| Name | Calculus (I)(A) |
| No. | MAT0551 |
| Credits | 5.5 |
| Description | This course covers the following topics:   1. Functions 2. Limits and Continuity 3. Derivatives and Differentials 4. Mean Value Theorem of Differentials and The Application of Derivatives 5. Indefinite Integrals 6. Definite Integrals 7. Differential Equations |

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| Name | Introduction to Information Technologies |
| No. | SSE0591 |
| Credits | 1.5 |
| Description | This course provides an overview of the history and trends of information technology, as well as the basic concepts and skills related to computers. |

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| Name | Chinese |
| No. | CHI0001 |
| Credits | 2 |
| Description | This course includes appreciation of Chinese literature. |

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| Name | Comprehensive English(I) |
| No. | SFL0001 |
| Credits | 3.5 |
| Description | This course aims to expand students’ vocabulary, enhance students’ grasp of English grammar, and develop students’ reading and listening comprehension skills. |

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| Name | Football (level 1) |
| No. | - |
| Credits | 1 |
| Description | This course covers football theories and practices. |

2020-2021 2nd Semester

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| Name | City and Cultural Heritage |
| No. | - |
| Credits | 2 |
| Description | This course introduces famous cities and culture heritage around the world. |

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| Name | Physics (I) |
| No. | PHY0511 |
| Credits | 4 |
| Description | This course contains theories about mechanics and electromagnetics. |

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| Name | Discrete Mathematics |
| No. | SSE0551 |
| Credits | 5 |
| Description | This course mainly includes:   1. Mathematical logic: propositional logic and formal systems, predicate logic and formal systems; 2. Sets: fundamental concepts of sets, relationships between sets, operations on sets, set partitioning and covering, standard form of sets, infinite sets; 3. Relations: Cartesian product, fundamental concepts of relations, operations on relations, properties of relations, closure of relations, different types of relations such as equivalence relation; 4. Functions: concepts and properties, composite function, inverse function; 5. Algebraic system: semigroups, groups, rings, fields, lattices and Boolean Algebra; 6. Graph theories: Eulerian graphs, Hamiltonian graphs, Planar graphs, shortest path, Bipartite Graph and Trees. |

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| Name | Studies on Historical Figures of Republic of China (1912–49) |
| No. | - |
| Credits | 2 |
| Description | This course introduces historical figures of China in the early 1900s. |

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| Name | Ideological and Political Course Social Practice |
| No. | - |
| Credits | 0 |
| Description | This course includes a social research project. |

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| Name | Calculus (I)(B) |
| No. | MAT0531 |
| Credits | 5.5 |
| Description | This course covers the following topics:   1. Space Analytic Geometry and Vector Algebra 2. Differentiation of Functions of Several Variables 3. Multiple Integrals 4. Line (Curve) Integrals and Surface Integrals 5. Infinite Series. |

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| Name | Experiments of Physics(I) |
| No. | PHY0551 |
| Credits | 1 |
| Description | This course introduces the basic laboratory equipment and techniques used in mechanics and electromagnetism experiments. |

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| Name | Linear Algebra |
| No. | MAT0721 |
| Credits | 2.5 |
| Description | This course introduces the linear theory and methods of finite-dimensional linear spaces. It covers the following topics:   1. Systems of Linear Equations 2. Matrices and Matrix Operations 3. Linear Transformations 4. Determinants 5. N-Dimensional Vector Spaces 6. Eigenvalues and Eigenvectors 7. Similarity and Diagonalization 8. Quadratic Form. |

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| Name | Survey of Modern Chinese History |
| No. | MAX0042 |
| Credits | 2.5 |
| Description | This course is about Chinese history after the foundation of PRC. |

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| Name | Engineering Internship |
| No. | SSE3611 |
| Credits | 1 |
| Description | This course includes an internship project of developing a game using Unity game engine and c#. |

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| Name | Comprehensive English (II) |
| No. | SFL0011 |
| Credits | 3.5 |
| Description | This course aims to improve students’ English proficiency in various aspects, such as vocabulary, grammar, reading, writing, listening, and speaking. |

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| Name | Football (level 2) |
| No. | - |
| Credits | 1 |
| Description | Football (level 2) |

2021-2022 1st Semester

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| --- | --- |
| Name | Physics (II) |
| No. | PHY0521 |
| Credits | 4 |
| Description | This course includes thermotics, vibration and wave, optics, and the foundation of modern physics (consisting of introductions to relativity, quantum mechanics and atomic physics). |

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| Name | Complex Function and Integral Transform |
| No. | MAT0561 |
| Credits | 2.5 |
| Description | This course includes:   1. Complex Numbers and Complex Functions, 2. Analytic Functions, 3. Complex Integrals, 4. Series Expansion of Analytic Functions, 5. Residue and Related Applications, 6. Conformal Mapping, 7. Fourier Transforms, 8. Laplace Transforms |

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| Name | Probability Theory and Mathematical Statistics |
| No. | MAT0591 |
| Credits | 2.5 |
| Description | This course aims to help students understand the basic concepts and methods of probability theory and mathematical statistics. It covers the following topics:   1. Random Events and Probability Spaces; 2. Random Variables and Probability Distributions; 3. Properties of Random Variable; 4. Characteristic Functions of Random Variables; 5. Laws of Large Numbers and Central Limit Theorems; 6. Introduction to Mathematical Statistics; 7. Parameter Estimation; 8. Hypothesis Testing; |

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| Name | Assembly Language |
| No. | SSE0621 |
| Credits | 2 |
| Description | This course teaches the NASM, as well as the basic architecture of computers, especially CPUs, and the connection between high-level programming and low-level computer operations. The main topics of this course are:   1. Architecture of IBM-PC microcomputer, 2. Variables and constants in assembly language, 3. Addressing modes and instruction system, 4. Program structures in assembly language: branch and loop, 5. Procedure design with several parameter passing methods 6. Macros and pseudo instructions |

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| Name | Assembly Language Labs |
| No. | SSE0621 |
| Credits | 0.5 |
| Description | This is the experiment part of Assembly Language course. |

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| Name | Decoding National Security |
| No. | - |
| Credits | 2 |
| Description | This course introduces fundamental theory of national security. |

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| Name | Introduction to Basic Principles of Marxism |
| No. | MAX0013 |
| Credits | 2.5 |
| Description | This course introduces fundamental theory of Marxism. |

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| Name | Object-Oriented Programming |
| No. | SSE2031 |
| Credits | 2 |
| Description | This course is an introduction to object-oriented programming using the Java programming language. It aims to teach the fundamental concepts and techniques that form the object-oriented programming paradigm. This course covers an in-depth study in the Java programming language, a comparison of structure and object-oriented programming, OO concepts and principles, and problem-solving in the OO paradigm. |

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| Name | Course Project of Object-Oriented Programming |
| No. | SSE3571 |
| Credits | 0.5 |
| Description | This is the experiment part of Object-Oriented Programming. It covers the process of designing, documenting, and implementing software programs using object-oriented thinking, UML diagrams, and Java language. |

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| Name | Volleyball (level 1) |
| No. | - |
| Credits | 1 |
| Description | This course includes theories and practices of volleyball. |

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| Name | Data Structure |
| No. | SSE0561 |
| Credits | 3 |
| Description | This course introduces properties, operations, and usage of basic data structures, including Arrays (including Suffix Arrays), Stacks (including Monotonic Stacks), Queues, Linked Lists, Trees (Binary Trees, Red-Black Trees, AVL, BST, B-Trees, Trie, Segment Trees, Binary Indexed Trees), Hash Tables, Heaps, Graphs, Disjoint Set Unions, etc. |

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| Name | Course Project of Data Structure |
| No. | SSE3601 |
| Credits | 0.5 |
| Description | This is the experiment part of the Data Structure course, which covers the implementation of basic data structures using C programming language. |

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| Name | Speculation and Innovation |
| No. | - |
| Credits | 2 |
| Description | This course is about entrepreneurship and innovation skills. |

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| Name | Experiments of Physics (II) |
| No. | PHY0561 |
| Credits | 0.75 |
| Description | This is the experiment part of the Physics (II) course, including experiments about thermotics, vibration and wave, optics, etc. |

2021-2022 2nd Semester

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| Name | Principles of Operating Systems |
| No. | SSE0521 |
| Credits | 3 |
| Description | This course covers general principles of operating systems, especially Linux. It includes operating system structure, process management, memory management, device management, file system, etc. It aims to enable students to understand basic functions, structure and principles of operating systems, analyze and modify existing open-source codes of operating systems, and design simple operating systems. |

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| Name | Operating Systems Principles Labs |
| No. | SSE0522 |
| Credits | 1 |
| Description | This is the lab course of the Principles of Operating Systems course, which includes projects about inter-process communication, file systems, Linux module programming, etc., and a final project: building an operating system with memory paging using assembly language. |

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| Name | Computational Methods |
| No. | MAT0741 |
| Credits | 2.5 |
| Description | This course includes the principles, analysis, and Python implementations of the following computational methods:   1. Numerical solutions for non-linear equations; 2. Numerical solutions for systems of linear equations; 3. Interpolation methods and curve fitting (using regularization and least-square method); 4. Numerical integration and numerical differentiation; 5. Numerical solutions for initial value problem of ordinary differential equations |

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| Name | General Introduction to Mao Zedong Thought and Socialist Theory with Chinese Characteristics |
| No. | MAX0002 |
| Credits | 4.5 |
| Description | This course introduces Mao Zedong Thought. |

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| Name | Volleyball (level 2) |
| No. | - |
| Credits | 1 |
| Description | This course includes theories and practices of volleyball. |

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| Name | Human-Computer Interaction |
| No. | SSE5261 |
| Credits | 2 |
| Description | This course covers the basic concepts, principles and methods of HCI, UI, usability engineering and interaction design. Topics include:   1. Introduction to HCI and UX; 2. Human cognitive and physical abilities; 3. Interaction design principles; 4. Prototype design and evaluation; 5. Graphical design fundamentals; 6. Universal design 7. Mobile interaction design; 8. Introduction to augmented-reality (AR); 9. Introduction to virtual-reality (VR); |

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| Name | Introduction to Software Engineering |
| No. | SSE2041 |
| Credits | 2 |
| Description | This course teaches the basic theory, practice and tools of software engineering. It covers the following topics:   1. Software processes 2. Agile software development 3. Requirements engineering 4. System modeling 5. Architectural design 6. Design and Implementation 7. Software testing 8. Software Evolution |

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| Name | Digital Logic |
| No. | SSE0581 |
| Credits | 3 |
| Description | This course covers fundamentals of digital logic circuits design, which includes:   1. Digital signals and number systems, 2. Logic symbols and Boolean algebra, 3. Gates and triggers 4. Combinational logic circuits, 5. Synchronous sequential circuits, 6. Asynchronous sequential circuits, 7. Introduction to Logisim 8. Field programmable logic devices (FPLDS) 9. Introduction to Vivado 10. Medium scale integration (MSI) |

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| Name | Algorithmic Design & Analysis |
| No. | SSE2121 |
| Credits | 2.5 |
| Description | This course mainly includes:   1. Basics techniques, such as asymptotic notation, divide-and-conquer technique, probabilistic analysis and randomized algorithms; 2. Sorting Algorithms, such as bubble sort, selection sort, insertion sort, shell sort, merge sort, heap sort, quick sort, counting sort, radix sort, bucket sort, counting sort and selection algorithms; 3. Graph Algorithms, such as BFS, DFS, topological sort, MSTs, shortest paths and maximum network flow; 4. Others: dynamic programming, greedy algorithms, FFT, string matching, and NP-completeness. |

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| Name | On Astronomy |
| No. | - |
| Credits | 2 |
| Description | This course provides an overview of astronomy. |

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| Name | Engineering Internship |
| No. | SSE3621 |
| Credits | 1.5 |
| Description | This course includes a Web application development using Javascript, HTML, CSS, React, Java, Springboot, MySQL. |

2022-2023 1st Semester

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| Name | Compiler Techniques |
| No. | SSE0511 |
| Credits | 3 |
| Description | The course introduces the principles of compiling, including:   1. Grammar and Language 2. Automata and Lexical Analysis, 3. Top-Down Syntax Analysis, 4. Bottom-Up Syntax Analysis, 5. LR Parsing, 6. Syntax Directed Semantic Analysis, 7. Static Semantic Analysis and Intermediate Code Generation, 8. Memory Organization and Allocation, 9. Code Optimization and Object Code Generation. |

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| Name | Course Project of Compiler Techniques |
| No. | SSE3701 |
| Credits | 0.5 |
| Description | This project is to build a simplified C compiler using the following tools: lex for lexical analysis and yacc for syntax and semantics analysis. |

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| Name | Computer Games Engines |
| No. | SSE5581 |
| Credits | 2 |
| Description | This course teaches about the basic architecture of game engines, fundamentals of computer graphics, developing games using C# and Unity, etc. It covers:   1. Introduction to C# and Unity; 2. Computer graphics and rendering system, including: 2D/3D transformations, polygonal meshes, curves, surfaces, graphics rendering pipeline, lighting and shading, texture mapping, rasterization, ray tracing, geometric modeling, OpenGL and Shader; 3. Other components in game engines: animation system, physics engine, script programming, user interface, audio system; 4. Introduction to AI used in games; 5. Introduction to online game technology; |

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| Name | Principles of Computer Organization |
| No. | SSE5581 |
| Credits | 3 |
| Description | This course is about computer architecture and it covers:   1. Computer systems hierarchy; 2. Data representation, error detection and correction; 3. Data computing methods and ALU design; 4. Memory system: cache (basic principles, addressing methods and replacement algorithms), main memory (SRAM & DRAM, main memory expansion), virtual memory, and auxiliary memory (RAID storage); 5. Instruction system and addressing modes, take MIPS for instance; 6. CPU: architecture and functions, data paths and instruction cycle, controller design (hardwired and microprogrammed), microprogramming; 7. Single and multiple cycle MIPS processor design; 8. System bus design: 3 types of buses, bus arbitration, data transfer methods; 9. I/O system: I/O interfaces, interrupts, DMA. |

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| Name | Object-Oriented System Analysis and Design |
| No. | SSE5211 |
| Credits | 3 |
| Description | This course introduces information system analysis and design by object-oriented methods. It enables students to develop object-oriented systems using the following tools:   1. GRASP principles; 2. OOP design patterns, including: Singleton Pattern, Factory Method Pattern, Builder Pattern, Adapter Pattern, Proxy Pattern, Decorator Pattern, Composite Pattern, Observer Pattern, State Pattern, etc. 3. Unified Modeling Language (UML), which includes class diagrams, state diagrams, sequence diagrams, etc. 4. Object-Oriented Analysis (OOA); 5. Object Modeling Technique (OMT); 6. Objectory and Fusion. |

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| Name | Course Project of Object-Oriented system Analysis and design |
| No. | SSE3581 |
| Credits | 0.5 |
| Description | This project includes several OOD exercises. |

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| Name | Software Architecture |
| No. | SSE2071 |
| Credits | 3 |
| Description | This course introduces basic knowledge about software architecture. It covers the following topics:   1. Software architecture styles and patterns; 2. Software architecture description; 3. SADPBA and its application on MEECS system; 4. ArchStudio and ArchWare-ides for software architecture development; 5. Evaluation of software architecture; 6. Flexible software architecture; 7. Prospects of software architecture; |

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| Name | Database Systems Principles |
| No. | SSE0641 |
| Credits | 3 |
| Description | This course introduces basic theories about relational database and DBMS. It covers the following topics:   1. Database system and data model; 2. Relational database; 3. Database operation language: SQL; 4. Query processing and optimization; 5. Normal forms and normalization of relational database; 6. Database design; 7. Database security; 8. Database integrity; 9. Transaction processing; 10. Database recovery; 11. Concurrency control; 12. Database Management System (DBMS); |

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| Name | Database Systems Principles Labs |
| No. | SSE0642 |
| Credits | 1 |
| Description | This project requires students to build up a relational database using MySQL and various techniques. |

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| Name | Mathematical Modeling and Optimization |
| No. | SSE5521 |
| Credits | 3 |
| Description | This Course introduces some basic theories about mathematical modeling and optimization, and ways to implement them in MATLAB. It covers 3 topics:   1. Convex optimization, including:    1. Convex sets    2. Convex functions    3. Convex optimization problems    4. Duality 2. Numerical optimization, including:    1. Gradient descent methods    2. Subgradient methods    3. Newton and Quasi-Newton methods    4. Non-linear least squares methods    5. Augmented Lagrangian Methods (ALM)    6. Nesterov acceleration    7. Dual methods 3. Mathematical modeling, including:    1. Modeling with differential equations,    2. Modeling with algebraic equations and difference equations,    3. Graphs as models,    4. Regression models,    5. Game theory models,    6. Markov chain models,    7. Dynamic optimization models. |

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| Name | Digital Image Processing Techniques |
| No. | SSE5321 |
| Credits | 2.5 |
| Description | This course focuses on the basic concepts and algorithms of digital image processing. It covers:   1. Digital Image Fundamentals; 2. Intensity Transformations and Spatial Filtering; 3. Filtering in the Frequency Domain; 4. Image Restoration and Reconstruction; 5. Color Image Processing; 6. Image Compression; 7. Morphological Image Processing; 8. Image Segmentation; 9. Feature Extraction; |

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| Name | Microcomputer Principle and Interface Techniques |
| No. | SSE5351 |
| Credits | 3 |
| Description | The course covers the following topics:   1. Internal structure of the Intel 8086/8088 microprocessor, 2. Instruction system and assembly language program design, 3. Memories and addressing, 4. Interrupts, 5. I/O interfaces, 6. Hardware-Software Integration system design and debugging. |

2022-2023 2nd Semester

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| Name | ERP and Supply Chain |
| No. | SSE5041 |
| Credits | 2 |
| Description | This course introduces basic theories about ERP software. It requires students to:   1. Understand basic concepts of ERP, such as reorder point, time buckets, time fences, independent and dependent demand, net and gross requirement, etc.; 2. Be able to develop a simple software that implements management subsystems for production schedules, materials, production capacity, production orders, and workshops. |

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| Name | Innovative Thinking and Practice |
| No. | SSE0611 |
| Credits | 1 |
| Description | This course is an introduction to innovation skills. |

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| Name | Computer Networks |
| No. | SSE5191 |
| Credits | 3 |
| Description | This course covers the basic principles of computer network with a focus on TCP/IP protocol stack. The main topics include:   1. Network and protocol architectures (OSI and TCP/IP model); 2. Application layer: protocols including HTTP, SMTP, DNS, P2P; 3. Transport layer: UDP and TCP protocol, reliable data transfer principles, flow and congestion control; 4. Network layer data plane: IP protocol, routing, generalized forwarding and SDN; 5. Network layer control plane: routing algorithms, routing inside AS: OSPF, routing between ISPs: BGP, ICMP; 6. Link layer and LAN: link layer introduction, error detection and correction, multiple access problem, MAC address and ARP, Ethernet, VLAN; 7. Wireless network and mobile network: 802.11 WLAN, cellular internet and roaming; 8. Network security: HTTPS, SSL, firewalls, VPN |

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| Name | Critical Thinking |
| No. | SSE0631 |
| Credits | 1 |
| Description | This is an introduction course to critical thinking. Topics include:   1. Overview of Critical Thinking; 2. Anatomy of Arguments: Conclusions, Premises, Etc. 3. Toulmin Model of Argument; 4. Non-Deductive Reasoning: Abductive Reasoning, Analogical Reasoning, Inductive Reasoning, Etc. 5. Deductive Reasoning; 6. Lines of Reasoning; 7. Complete Assessments of Critical Thinking; 8. Constructing Arguments; |

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| Name | Software Process Management |
| No. | SSE2061 |
| Credits | 2 |
| Description | This course teaches basic theories of software process management. It covers the following topics:   1. Project management, including planning, tracking, and risk management; 2. Requirement engineering; 3. Technical implementation, including system design, integration, verification, and validation; 4. Process management, including process modeling, measurement and analysis. |

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| Name | Software Documentation Writing |
| No. | SSE2081 |
| Credits | 1 |
| Description | This course teaches how to write software documentation, which includes user documentation (manuals and tutorials), technical documentation (design documents, API references, test cases), and process documents (requirements documents, project plans, risk assessments, configuration management plans) |

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| Name | Software Quality and Testing |
| No. | SSE2091 |
| Credits | 2.5 |
| Description | This course introduces software quality assurance and testing. It includes:   1. The background and concept of software testing; 2. Software testing methods: static/dynamic black-box testing, static/dynamic white-box testing; 3. Software testing applications: unit tests, functional testing, performance testing and usability testing; 4. The automated testing and test tools: pytest, junit, etc.; 5. Test management and related tools; 6. Software quality assessment models; 7. Test documentation, test plans, reports and evaluation. |

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| Name | Engineering Internship |
| No. | SSE3611 |
| Credits | 2 |
| Description | This course includes an Android application development using Kotlin. |