

Department-specific Guidelines for Double Major and Minor

1. Double Major Requirements

If the MR courses in the double major department total 35 or more credits, all MR courses must be completed. If they total fewer than 35 credits, all MR courses must still be completed, along with additional ME courses—including Approved ME Courses Offered by Other Departments (by the student's primary major)—as needed to reach at least 35 credits. Double-counting of credits from the same course toward both the primary major and the double major is permitted.

2. Minor Requirements

At least 21 credits must be completed in accordance with the minor requirements of the respective department. Double-counting of credits from the same course toward both the primary major and the minor is not permitted.

Department	Double Major	Minor
Mathematics	-Complete at least 35 credits, including 3 credits in MR, 12 credits in DME, and 12 credits in ME offered by the Department. -Fulfill the graduation requirement by either submitting a bachelor's thesis or, at the student's request, taking the graduation qualification exam. -Probability and Statistics, Statistics for Experimental Research, and Basic Engineering Statistics are considered equivalent courses. However, Statistics for Experimental Research and Basic Engineering Statistics are not accepted as DME for either the Mathematics major or minor.	-Complete at least 21 credits, including 3 credits in a MR, 12 credits in DME, and 6 credits in ME. -Probability and Statistics, Statistics for Experimental Research, and Basic Engineering Statistics are considered equivalent courses. However, Statistics for Experimental Research and Basic Engineering Statistics are not accepted as DME for either the Mathematics major or minor.
Physics	- Complete more than 38 credits in major courses including: -27 credits in MR -At least 11 credits in ME courses offered by the Department (including Introduction to Quantum Physics and Introduction to the Theory of Relativity, if desired) -The undergraduate thesis requirement is waived.	- Complete at least 21 credits in major courses including: -9 credits in MR: Mechanics, Electromagnetism I, and Quantum Physics I -3 credits in ME: Choose one from Electromagnetism II, Quantum Physics II, or Thermal Physics -9 additional credits: Choose from among MR or ME courses offered by the Department
Chemistry	Complete at least 30 credits in MR and 5 credits in ME courses offered by the Department.	Complete at least 21 credits in MR and ME offered by the Department.
Life Sciences	Complete 25 credits in MR and an additional 10 credits in ME designated by the Department.	Complete 9 credits in the following required courses offered by the Department: LIFE217 (Cell Biology), LIFE319 (Biochemistry I), and LIFE321 (Molecular Biology). In addition, complete 12 more credits from MR or ME offered by the Department, for a total of 21 credits.
Materials Science and Engineering	Complete 19 credits in MR and 6 credits in DME, plus additional courses approved as ME, for a total of 35 credits.	Complete 15 credits in MR and two introductory courses (6 credits) from DME, excluding Senior Research Project I and II, for a total of 21 credits.
Mechanical Engineering	Complete at least 37 credits, including 22 credits in MR, 12 credits in DME, and at least 3 credits in ME.	Complete at least 21 credits in MR and DME.

Department	Double Major	Minor
Industrial and Management Engineering	-Complete at least 35 credits, including all 27 credits in MR courses, plus additional credits in ME courses, both offered by the Department. -However, only ME courses offered by the Department are eligible for credit recognition. -IMEN272 (Probability and Statistics for Engineering) may be substituted with MATH230 (Probability and Statistics) or MATH231 (Statistics for Experimental Research).	-Complete at least 21 credits in MR and ME courses offered by the Department. -However, only ME courses offered by the Department are eligible for credit recognition. -IMEN382 (Database System) may be substituted with CSED357 (Database Systems). -IMEN272 (Probability and Statistics for Engineering) may be substituted with MATH230 (Probability and Statistics) or MATH231 (Statistics for Experimental Research).
Electronics and Electrical Engineering	-MR: 28 credits [Common Required Courses - 7 credits] EECE231 Circuit Theory (3), EECE233 Signals and Systems (3), EECE491 Capstone Design Project 1 (1) [Track Required Courses - 9 credits] Students must choose one of the following two tracks: ►Systems Track (9 credits): EECE202 Introduction to Probability and Random Processes (3) EECE274 Digital System Design (3) EECE320 Introduction to Automatic Control (3) ►Devices Track (9 credits): EECE211 Semiconductor Electronics I (3) EECE261 Introduction to Electromagnetics (3) EECE331 Electronic Circuits I (3) [Common Elective-Required Courses - 12 credits] At least 9 credits from EE major courses and 3 credits from Mathematics. -ME: 7 credits Students must complete at least 7 credits from the following: EE courses offered by the School of Electrical and Electronic Engineering, approved EE-related courses offered by other departments, STC courses offered by other departments, and major-required courses offered by other departments. [Course Substitutions] CSED273 Digital System Design may be substituted for EECE274 Digital System Design; CSED241 Introduction to Computer Architecture may be substituted for EECE375 Computer Design; CSED211 Introduction to Computer Software systems may be substituted for EECE372 Microprocessor Architecture and Applications; and PHYS206 Electromagnetism I may be substituted for EECE261 Introduction to Electromagnetism.	-MR: 16 credits [Common Required Courses - 7 credits] EECE231 Circuit Theory (3), EECE233 Signals and Systems (3), EECE491 Capstone Design Project 1 (1) [Track Required Courses - 9 credits] Students must choose one of the following two tracks: ►Systems Track (9 credits): EECE202 Introduction to Probability and Random Processes (3) EECE274 Digital System Design (3) EECE320 Introduction to Automatic Control (3) ►Devices Track (9 credits): EECE211 Semiconductor Electronics I (3) EECE261 Introduction to Electromagnetics (3) EECE331 Electronic Circuits I (3) -ME: 5 credits Students must complete at least 5 credits from the following: EE courses offered by the School of Electrical and Electronic Engineering, approved EE-related courses offered by other departments, STC courses offered by other departments, and major-required courses offered by other departments. [Course Substitutions] CSED273 Digital System Design may be substituted for EECE274 Digital System Design; CSED241 Introduction to Computer Architecture may be substituted for EECE375 Computer Design; CSED211 Introduction to Computer Software systems may be substituted for EECE372 Microprocessor Architecture and Applications; and PHYS206 Electromagnetism I may be substituted for EECE261 Introduction to Electromagnetism.
Computer Science and Engineering	Complete all MR courses, at least 6 credits in DME courses, and a minimum of 35 total credits including ME courses. EECE274 Digital System Design may be substituted for CSED273 Digital System Design offered by the Department. EECE375 Computer Design may be substituted for CSED241 Introduction to Computer Architecture offered by the Department.	Complete at least 15 credits in MR courses and at least 6 credits in DME courses, for a total of at least 21 credits.
Chemical Engineering	Complete all MR courses in the Department (30 credits) as well as at least 5 additional credits in the Department's ME courses.	-MR: 9 credits in CHEB204 Chemical Engineering Thermodynamics, CHEB305 Reaction Engineering, and CHEB417 Transport Phenomena -12 additional credits in 300-level or higher courses offered by the Department.

Department	Double Major	Minor
Biomedical Engineering	-Students enrolled in 2022 or earlier: 32 credits in all MR courses and 3 credits in ME for a total of 35 credits -Students enrolled in 2023 or later: 23 credits in all MR courses and 12 credits in ME for a total of 35 credits	-Students enrolled in 2022 or earlier: 24 credits including 21 credits in 창의IT설계 Level I-IV (CITE201, CITE202, CITE301, and CITE302) and 3 credits in the Creative Studio course group (CITE203, CITE303, CITE304, CITE306, and CITE405) -Students enrolled in 2023 or later: 24 credits including 15 credits in (CITE201, CITE202, and CITE301); 3 credits in the Creative Studio course group (CITE203, CITE303, CITE304, CITE306, and CITE405); and additional ME credits as needed.
Semiconductor or Engineering	Complete all 26 credits in MR and 9 credits in ME, for a total of at least 35 credits.	Complete 15 credits in MR and 6 credits in ME, for a total of at least 21 credits.

3. Interdisciplinary Double Major Requirements

At least 35 credits must be completed in accordance with the interdisciplinary double major requirements. Double-counting of credits from the same course toward both the primary major and the interdisciplinary double major is permitted.

4. Interdisciplinary Minor Requirements

At least 21 credits must be completed in accordance with the interdisciplinary minor requirements. Double-counting of credits from the same course toward both the primary major and the interdisciplinary minor is permitted.

Discipline	Double Major	Minor
Entrepreneurship	-	Credits may be double-counted toward graduation requirements for the primary major or double major.) -Requirements (9 credits) : ENTP201 (IMEN411) Introduction to Entrepreneurship (3) ENTP301 (IMEN412) Action Learning in Business Planning (3) or CITE411 Applied Creative Entrepreneurship (3) ENTP491 Entrepreneurship Seminar (1), ENTP492 Entrepreneurial Practice and Planning (2) -Electives (12 credits) : IMEN203 Financial Accounting (3), IMEN301 Technology Management and Strategy (3), IMEN302 Principles of Business Administration (3), IMEN303 Marketing (3), IMEN304 Strategic Management (3), IMEN305 Organizational Behavior (3), IMEN400 Emerging Technology and Innovation (Varied Credits), IMEN371 Quality Management (3), IMEN422 Supply Chain Management (3), IMEN423 Product Lifecycle Engineering (3), IMEN462 Pricing and Revenue Management (3), IMEN482 Introduction to SSME (Service Science, Management, and Engineering (3), IMEN487 Corporate Finance (3) CMEF301 Principles of Economics (3), SOSC354 Group Communication and Leadership (3), SOSC451 Persuasion and Social Influence (3), CMEF303 Macroeconomics (3), CMEF304 Financial Economics (3), CMEF305 Financial Management (3), CMEF402 Money and Banking (3), CMEF405 Introduction to Fixed Income Markets (3), CMEF407 Industrial Organization (3), CMEF411 Market Design (3) SOSC459 Special Topics in Communication (3) ENTP493 Special Topics in Entrepreneurship (Varied Credits), ENTP451A-Z Special Topics in Start-up Practice A-Z (Varied Credits) CITE203 Interaction Design Studio (3), CITE211 Human Resource and Organization Theory (2), CITE212 Technology Financing (2), CITE213 Technology Marketing (2), CITE214 Economics of Technological Innovation (3), CITE215 Introduction to Makers (3), CITE303 Life Sensibility and Transhuman Studio (3), CITE306 Business Model Studio (3), CITE311 Technology Innovation and Commercialization (3), CITE312 Entrepreneurship (2) INTN301 Start-up Internship Practicum (Varied Credits), INTN302 Start-up Practicum (Varied Credits)

Discipline	Double Major	Minor
Science and Technology Studies	-	*Each student may choose and complete only one interdisciplinary minor from among Science and Technology Studies, and Economics and Finance. *Any three courses (9 credits) may be recognized as Humanities and Social Sciences Electives (HSSE), regardless of whether they are Basic or Advanced Courses. *Applicants must complete at least one Capstone course (1 credit). 21 credits (may be completed without distinction between basic and advanced courses) 1) Basic Courses CMST301 Logic and Critical Thinking (3), CMST302 History of Science (3), CMST303 Philosophy of Science (3), CMST304 Science Technology Studies (3), CMST305 Sociology of Science (3), CMST307 History of Science and Technology in Korea (3), CONF319 Special Topics in Confluence (3), SOSC337 Introduction to Human Evolution (3), ARTS315 The Origin of Images and visual Literacy (3) 2) Advanced Courses CMST401 Policy for Science and Technology (3), CMST402 Science Communication (3), CMST404 History of Science and Technology in East Asia (3), CMST406 Philosophy of Spacetime and Matter (3), CMST408 Body and Technology (3), CMST409 Evolution and Human Society (3), CMST410 Risk Society and Communications (3), CMST411 Artificial Intelligence and Law (3), CMST412 Modern Society and Science (3), ARTS412 Art, Science, and Technology (3), SOSC412 Politics and Policymaking (3), CMST499 Special Topics in Science and Technology Studies (3), PHYS360 Pioneers in Physics (3)
Economics and Finance	-	*Each student may choose and complete only one interdisciplinary minor from among, Science and Technology Studies, and Economics and Finance. *Any three courses (9 credits) from the Basic Courses may be recognized as Humanities and Social Sciences Electives (HSSE). *Applicants must complete at least one Capstone course (1 credit). 21 credits (15 from Basic Courses + 6 from Advanced Courses) 1) Basic Courses – 15 credits (5 courses) CMEF301 Principles of Economics (3), CMEF302 Microeconomics (3), CMEF303 Macroeconomics (3), CMEF304 Financial Economics (3), CMEF305 Financial Management (3), CMEF306 Sustainability & ESG (3) 2) Advanced Courses – 6 credits (2 courses) CMEF401 Econometrics (3), CMEF402 Money and Banking (3), CMEF405 Introduction to Fixed Income Markets (3), CMEF406 Game Theory (3), CMEF407 Industrial Organization (3), CMEF408 Economics of Information (3), CMEF409 Law and Economics (3), CMEF410 Political Economy (3), CMEF411 Market Design (3), CMEF414 Behavioral-Experimental Economics (3), CMEF499 Special Topics in Economics (3) IMEN388 Investment Theory (3), IMEN487 Corporate Finance (3)
Next-Generation Communications and Networks	-	21 credits (MR 12 + ME 9) 1. MR – 12 credits -The course Introduction to Communications and Network (3-0-3) is required. -At least three DME courses (9 credits) must be completed, including: at least one from among Algorithms, Software Design Methods, Computer Networks; and at least one from among Introduction to Probability and Random Processes, Introduction to Communication Systems, Introduction to Digital Communication. -Courses Available: NGCN301 Introduction to Communications and Network CSED331 Algorithms, CSED332 Software Design Methods, CSED353 Computer Networks EECE202 Introduction to Probability and Random Processes, EECE341 Introduction to Communication Systems, EECE308 Introduction to Digital Communication 2. ME – 9 credits -Courses Available: NGCN302 Communications and Network Lab CSED342 Artificial Intelligence, CSED343 Mathematics for Machine Learning, CSED352 Data Communications, CSED415 Computer Security, CSED416 Peer-to-peer Networking, CSED417 Internet of Things, CSED500 Advanced Linear Algebra for CSE, CSED505 Network Performance Analysis, CSED530 Advanced Probability Theory for CSE EECE361 Applied Electromagnetic Waves, EECE414 Microelectronics 3B: RF/Analog Circuits, EECE451 Introduction to Digital Signal Processing, EECE574 Probability and Stochastic Process, EECE575 Communication and Sensing Systems, EECE576 Statistical Communication Theory, EECE577 Information Theory, EECE578 Digital Communications, EECE579 Information and Communication Security, EECE581 Digital Signal Processing, EECE582 Error-Correcting Codes, EECE583 Advanced Linear Algebra, EECE589 Modern Coding Theory MATH430 Theory of Mathematical Statistics, MATH442 Mathematics for AI, MATH448 Introduction to Coding Theory, MATH449 Introduction to Cryptography, MATH565 Coding Theory, MATH567 Algebraic cryptography, IMEN561 Network Theory 3. Note - Up to 9 credits (3 courses) from major courses offered by the Department of Computer Science and Engineering and the Department of Electronics and Electrical Engineering, designated as part of the interdisciplinary minor, may also be counted toward this minor. - “Mathematics for Machine Learning” and “Mathematics for AI” are considered equivalent courses, and only one of them can be recognized for credit.

Discipline	Double Major	Minor
Environment	-	21 credits (12 credits in courses offered by the Division of Environmental Science and Engineering + 9 credits in courses offered by other departments) *Credits may overlap with the graduation requirements of the primary or double major. 1. 12 credits in courses offered by the Division of Environmental Science and Engineering: EVSE101 Introduction to Environmental Science, EVSE202 Understanding Climate Change, EVSE490A Special Topics: Air Pollution and Mitigation Technologies, EVSE490B Special Topics: Ecology and Environment, EVSE490C Special Topics: Water Environment and Society, EVSE490D Special Topics: Environmental Monitoring and Practicum, EVSE579 Environmental Statistics INGE101 Modern Civilization and Environmental Technology 2. 9 credits in courses offered by other departments: CMEF306 Sustainability & ESG, MATH200 Differential Equations, MATH230/MATH231 Probability and Statistics/Statistics for Experimental Research, CHEM221 Organic Chemistry I, CHEM231 Introduction to Nanochemistry, CHEM243 Chemical Analysis, CHEM261 Chemistry for Medicine and Life, LIFE217 Cell Biology, LIFE219 Convergence of Biology and Engineering, MECH250 Thermodynamics, CHEB208 Fundamentals in Engineering Biology, CHEB214 Energy and Environmental Engineering
Eco-Friendly Energy Materials	-	21 credits *Credits may overlap with the graduation requirements of the primary or double major. 1. Required Courses – 6 credits CHEB412 Chemical Engineering Process for Rechargeable Battery (3), AMSE414 Energy Materials (3) 2. Elective Courses – 15 credits (Choose from the list below to fulfill 15 credits) CHEB202 Physical Chemistry for Chemical Engineering II (3), CHEB212 Physical Chemical Lab (2), CHEB214 Energy and Environmental Engineering (3), CHEB301 Programming and AI in Chemical Engineering (3), CHEB305 Reaction Engineering (3), CHEB314 Introduction to Intermolecular and Surface Forces (3), CHEB315 Smart Soft Materials Engineering (3), CHEB413 Introduction to Characterization of Energy and Environmental Materials (3), CHEB417 Transport Phenomena (3), CHEB427 Chemical Engineering Capstone Design (3), CHEB465 Structure and Properties of Polymers (3), CHEB469Y Special Topics: Quantum Chemistry in Chemical Engineering (3), CHEB469Z Special Topics: Introduction to Organic Materials (3), CHEB469A Special Topics: Eco-Friendly Energy Materials – Basics of Secondary Batteries (1), CHEB469B Special Topics: Eco-Friendly Energy Materials – Hydrogen Production (1), CHEB469C Special Topics: Eco-Friendly Energy Materials – Biosystems (1), CHEB562 Carbon-Based Materials for energy storage (3), CHEB563 Advanced Hydrogen Energy (3) CHEM311 Physical Chemistry II (4), CHEM314 Chemistry Lab II: Physical Chemistry and Instrumental Analysis (4), CHEM325 Contemporary Chemistry Lab (3), CHEM331 Inorganic Chemistry (4), CHEM342 Instrumental Analysis (3), CHEM451 Macromolecular Chemistry (3), CHEM481B Special Topics: Spectroscopic Analysis Capstone Design (3), CHEM481D Special Topics: Industry-Academia-Research Collaborative Colloquium (1), CHEM531 Advanced Inorganic Chemistry I (3), CHEM621 Organometallic Chemistry (3) AMSE313 Physics of Materials (3), AMSE341 Introduction to Ceramic Materials (3), AMSE344 Ceramics Design and Laboratory (3), AMSE361 Introduction to Polymer Materials (3), AMSE412 Nanoscience and Technology (3), AMSE513 Electrochemistry for Energy Applications (3) GIFT518 Intro to battery system (3), BATT532 Active materials for lithium-ion batteries (3), BATT618 Energy Storage System and Design (3), BATT714 Advanced Battery Science and Engineering (3), BATT715 Analysis techniques for nano & energy materials (3)

Discipline	Double Major	Interdisciplinary Minor
	35 credits or more (Credits may overlap with the graduation requirements of the primary or double major.)	21 credits or more (Credits may overlap with the graduation requirements of the primary or double major.)
Synthetic Biology	1. Required Courses At least one course must be completed in each of three different areas from the list below: [Physics and Chemistry] CHEM221 Organic Chemistry I (3), CHEB206 Organic Chemistry for Chemical Engineers I (3) [Life Sciences] CHEM461 Biochemistry (3), LIFE319 Biochemistry I (3), LIFE321 Molecular Biology (3) [Mathematical Sciences] MATH200 Differential Equations (3), MATH203 Applied Linear Algebra (3) [Chemistry-Materials Engineering Applications] AMSE207 Materials Chemistry (3), CHEB208 Fundamentals in Engineering Biology (3) 2. Elective Courses At least one course must be completed in each of three different areas from the list below: [Physics and Chemistry] PHYS312 Computational Physics (3), PHYS413 Biological Physics (3), CHEM261 Chemistry for Medicine and Life (3), CHEB207 Organic Chemistry for Chemical Engineers II (3) [Life Sciences] LIFE217 Cell Biology (3), LIFE219 Convergence of Biology and Engineering (3), LIFE320 Biochemistry II (3), LIFE325 Biotechnology (3), LIFE414 Systems Biology (3), LIFE619 Bioinformatics (3) [Mathematical Sciences] MATH230 Probability and Statistics (3), MATH231 Statistics for Experimental Research (3), MATH313 Introduction to Partial Differential Equations (3), MATH351 Introduction to Numerical Analysis (3), IMEN260 Operations Research I (3), IMEN272 Probability and Statistics for Engineering (3) (MATH230, MATH231, and IMEN272 are recognized as equivalent courses.) [Chemistry-Materials Engineering Applications] AMSE201 Fundamentals of Materials Science and Engineering (3), AMSE361 Introduction to Polymer Materials (3), AMSE407 Materials Analysis and Characterization (3), AMSE412 Nanoscience and Nanotechnology (3), AMSE416 Biomedical Materials (3), AMSE464 Polymer Properties and Applications (3) CHEB213 Engineering Biology Laboratory (2), CHEB216 Chemical Engineering Lab (3), CHEB301 Programming and AI in Chemical Engineering (3), CHEB308 Introduction to Biotechnology (3), CHEB409 Introduction to Synthetic Biology (3), CHEB417 Transport Phenomena (3), CHEB418 Energy & Mass Transfer (3), CHEB469D Special Topics: Introduction to Bioengineering (3), CHEB313 Introduction to Colloid and Interface Phenomena (3), CHEB469A Special Topics: Systems Biochemistry (3)	

Discipline	Double Major	Interdisciplinary Minor
	35 credits or more (Credits may overlap with the graduation requirements of the primary or double major.)	21 credits or more (Credits may overlap with the graduation requirements of the primary or double major.)
Biomedical Engineering	1. Required Courses 3 courses (12 credits) required [Biomedical Engineering] CITE241 Introduction to Biomedical Engineering (3) [Convergence Design] CITE201 Convergence IT Design I : Fundamentals (3), CITE202 Convergence IT Design II : Basic Design (6) 2. Elective Courses At least one course must be completed in each of three different areas from the list below: [Biomedical Engineering] CITE451 Biomaterials and Biofabrication Methods (3), CITE452 Bioelectronic Devices: Engineering for Diagnostics and Therapeutics (3), CITE453 Biological Systems and Signal Processing (3), CITE490C Advanced Topics: Introduction to Medicine (3), CITE490J Advanced Topics: Basic Clinical Pathology (3) [Life Sciences, Chemistry] LIFE216 Physiology (3), LIFE217 Cell Biology (3), LIFE220 Introduction of Biomedical Science (3), LIFE414 Systems Biology (3), LIFE419 An Introduction to Brain and Behavior (3) CITE390B Special Topics: Clinical Anatomy and Physiology for Science and Engineering (3) CHEM261 Chemistry for Medicine and Life (3), CHEM461 Biochemistry (3), CHEM481B Special Topics: Biomedical Chemistry (3) [Mechanical and Advanced Materials Engineering Applications] MECH280 Sensors and Measurements (3), MECH330 Materials Processing (3), MECH244 Mechanical Behaviors and Processing of Materials (3), MECH528 Human-Robot Interface (3), MECH427 Optics and Microscopy (3) AMSE416 Biomaterials (3) [Convergence Design] CITE301 Convergence IT DesignIII: Advanced Design (6), CITE302 Convergence IT DesignIV: System Integration (6)	