

The Graduate Program for M.Sc. Degree in Chemical Engineering (2020 Curriculum)

The degree of Master of Science in Chemical Engineering is obtained from the Faculty of Graduate Studies after fulfilling the following requirements:

1. Compliance with the regulations of awarding the Master's Degree at Jordan University of Science and Technology.
2. Successful completion of (at least) 34 credit hours (C.H.) in one of the following two tracks.

First: The Thesis Track

1. **Compulsory courses, (16) credit hours, as follows:**

Course Code	Course Name	C.H.
ChE 701	Mathematical Methods in Chemical Engineering	3
ChE 732	Advanced Chemical Reaction Engineering	3
ChE 741	Advanced Chemical Engineering Thermodynamics	3
ChE 766	Research Methodology & Experimental Design	3
ChE 771	Advanced Transport Phenomena	3
ChE 791	Seminar	1

2. **Elective courses, (9) credit hours, distributed as follows:**

- a. (9) credit hours selected from the following courses:

Course Code	Course Name	C.H.
ChE 702	Numerical Methods in Chemical Engineering	3
ChE 713	Nanomaterials Technology	3
ChE 742	Applied Statistical Mechanics	3
ChE 744	Advanced Heat Transfer	3
ChE 762	Process Analysis and Control	3
ChE 764	Optimization	3
ChE 772	Advanced Mass Transfer	3
ChE 773	Advanced Separation Processes	3
ChE 780	Special Topics	3
ChE 783	Air Pollution and Control	3
ChE 784	Water and Wastewater Treatment	3

- b. It is possible to study no more than (6) credit hours from other departments within the level of 700 or above if the course subject is related to the curriculum and has not been studied before. A pre-approval by the dean's office that is based on a recommendation from the department's committee is a must.

3. **Master Thesis (ChE 799): total of (9) credit hours as follows:**

Course Code	Course Name	C.H.
ChE 799A	Master Thesis	9
ChE 799B	Master Thesis	6
ChE 799C	Master Thesis	3
ChE 799D	Master Thesis	0

Second: The Comprehensive Exam Track

1. Compulsory courses, (25) credit hours, as follows:

Course Code	Course Name	C.H.
ChE 701	Mathematical Methods in Chemical Engineering	3
ChE 732	Advanced Chemical Reaction Engineering	3
ChE 741	Advanced Chemical Engineering Thermodynamics	3
ChE 762	Process Analysis and Control	3
ChE 771	Advanced Transport Phenomena	3
ChE 772	Advanced Mass Transfer	3
ChE 702	Numerical Methods in Chemical Engineering	3
ChE 773	Advanced Separation Processes	3
ChE 791	Seminar	1

2. Elective courses, (9) credit hours, distributed as follows:

a. (9) credit hours selected from the following courses:

Course Code	Course Name	C.H.
ChE 713	Nanomaterials Technology	3
ChE 742	Applied Statistical Mechanics	3
ChE 744	Advanced Heat Transfer	3
ChE 764	Optimization	3
ChE 780	Special Topics	3
ChE 783	Air Pollution and Control	3
ChE 784	Water and Wastewater Treatment	3

b. It is possible to study no more than (6) credit hours from other departments within the level of 700 or above if the course subject is related to the curriculum and has not been studied before. A Pre-approval by the dean's office that is based on a recommendation from the department's committee is a must.

3. Passing the Comprehensive Exam (ChE 798: Zero C.H.) after the completion of 34 credit hours of graduate course work.

Descriptions of the Graduate Courses in Chemical Engineering

ChE 701 Mathematical Methods in Chemical Engineering	3 C.H.
Advanced techniques of solutions of ordinary and partial differential equations applied to chemical engineering problems with emphasis on chemical reactions and transport processes as they occur in industrial chemical processing.	
ChE 702 Numerical Methods in Chemical Engineering	3 C.H.
Advanced techniques of numerical solutions of ordinary and partial differential equations. Advanced regression techniques. Applications to chemical engineering systems.	
ChE 713 Nanomaterials Technology	3 C.H.
Introduction to nanoscience and nanotechnology. Fundamental principles, including properties of nanomaterials and classification of nanomaterials. Synthesis of nanomaterials. Characterization of nanomaterials. Applications of nanomaterials. The major challenges in the nano-field in terms of nanomaterials dispersion, purity and mass production. Current research directions in nanoscience and nanotechnology.	
ChE 732 Advanced Chemical Reaction Engineering	3 C.H.
Kinetics of complex homogeneous and heterogeneous reactions. Advanced treatment of chemical reactor systems including nonisothermal and non-ideal flow systems. Tracer-based modeling of reactors. Segregation. Reactor stability	
ChE 741 Advanced Chemical Engineering Thermodynamics	3 C.H.
Review of the laws of thermodynamics. Thermodynamic analysis of chemical engineering processes. Phase and chemical equilibria. Fugacities of gas mixtures, liquid mixtures and solids. Solution theories. Uses of equations of state. Prediction of fluid thermodynamic properties.	
ChE 742 Applied Statistical Mechanics	3 C.H.
Review of the basic principles of classical and quantum mechanics. Thermophysical properties of: ideal gas, low-density real gases, Dense-gases, liquids and solids. Monte-Carlo and molecular dynamic simulations of thermophysical properties.	
ChE 744 Advanced Heat Transfer	3 C.H.
Multidimensional heat conduction. Free and forced convection. Boiling and condensation. Thermal Radiation. Thermal boundary layer analysis.	
ChE 762 Process Analysis and Control	3 C.H.
Sampled-data control theory with applications in digital computer control systems. Nonlinear methods of dynamic process analysis. Optimal control via calculus of variations and the maximum principle. This course includes lab/ simulation component.	
ChE 764 Optimization	3 C.H.
Single and multi-variable search techniques. Linear programming. Constrained and non-constrained optimization. Case studies.	
ChE 766 Research Methodology & Experimental Design	3 C.H.
Introduction to research methodology and designed experiments. Basic statistical methods and concepts. Analysis of variance (ANOVA). ANOVA Analysis with blocking. Factorial Experiments. Two level factorial design. Blocking and confounding. Regression and Modeling.	
ChE 771 Advanced Transport Phenomena	3 C.H.
Transport properties. Unified treatment of the transport of momentum, heat and mass. This course includes lab/ simulation component.	
ChE 772 Advanced Mass Transfer	3 C.H.
Diffusive and convective mass transfer. Kinematics and basic conservation principles for	

multicomponent systems. Mass transfer theories. Boundary layers. Interfacial mass transfer. Mass transfer with chemical reactions. Advanced mass transfer operations.

ChE 773 Advanced Separation Processes**3 C.H.**

Generation of separation schemes. Applications of chemical engineering principles for separation of multicomponent systems, such as adsorption-desorption, membrane and other novel separation techniques.

ChE 780 Special Topics**3 C.H.**

A Structured course on advanced topics in chemical engineering and is counted only once towards the graduation requirements

ChE 783 Air Pollution and Control**3 C.H.**

Sources and nature of air pollution. Effect of air pollutants on environment. Design and behavior of air pollution control equipment. Case studies.

ChE 784 Water and Wastewater Treatment**3 C.H.**

Water chemistry. Water Treatment for drinking and industrial uses. Characterization of domestic and industrial wastewater. Physical, chemical and biological treatments. Applications. Government and municipal regulations. This course includes lab/ simulation component.

ChE 791 Seminar**1 C.H.**

The student is supposed to attend at least 90% of the seminars held in the enrollment semester and to submit a 'state of the art' report about a topic of his/her choice not related to his/her thesis. The student must, also, successfully, defend the report in an open seminar.

ChE 798 Comprehensive Exam**0 C.H.**

A written exam covers all the program core courses. The exam is administered by the graduate program committee in the department.

ChE 799A Master Thesis**9 C.H.**

Conducting original research in the field of chemical engineering under the supervision of a faculty member from the university. Submitting a thesis in accordance to the proposal submitted to the faculty of graduate studies. Passing the thesis defense. Fulfilling the faculty of graduate studies master thesis regulations.

ChE 799B Master Thesis**6 C.H.**

Conducting original research in the field of chemical engineering under the supervision of a faculty member from the university. Submitting a thesis in accordance to the proposal submitted to the faculty of graduate studies. Passing the thesis defense. Fulfilling the faculty of graduate studies master thesis regulations.

ChE 799C Master Thesis**3 C.H.**

Conducting original research in the field of chemical engineering under the supervision of a faculty member from the university. Submitting a thesis in accordance to the proposal submitted to the faculty of graduate studies. Passing the thesis defense. Fulfilling the faculty of graduate studies master thesis regulations.

ChE 799D Master Thesis**0 C.H.**

Conducting original research in the field of chemical engineering under the supervision of a faculty member from the university. Submitting a thesis in accordance to the proposal submitted to the faculty of graduate studies. Passing the thesis defense. Fulfilling the faculty of graduate studies master thesis regulations.