The Graduate Program for M.Sc. Degree in Chemical Engineering

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

1. Full commitment to the Jordan University of Science and Technology Dean Council regulations concerning the Degree of Master of Science.
2. Successful completion of (at least) 34 credit hours in one of the following two options.

First. **The Thesis Program**

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

Course No.	Course Name	C.H.
ChE 732	Adv. Chem. Reaction Eng.	3
ChE 741	Adv. Chem. Eng. Thermodynamics	3
ChE 762	Adv. Process Analysis and Control	3
ChE 771	Adv. Transport Phenomena	3
ChE 772	Adv. Mass Transfer	3
ChE 791	Seminar	1
		16

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

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

Course No.	Course Name	C.H.
ChE 701	Mathematical Methods in Chem. Eng.	3
ChE 702	Numerical Methods in Chem. Eng.	3
ChE 711	Adv. Materials Science	3
ChE 712	Corrosion	3
ChE 714	Colloids and Surface Chemistry	3
ChE 734	Catalysis	3
ChE 742	Applied Statistical Mechanics	3
ChE 743	Adv. Fluid Flow	3
ChE 744	Adv. Heat Transfer	3
ChE 745	Combustion	3
ChE 764	Optimization	3
ChE 773	Adv. Separation Processes	3
ChE 774	Fluidization	3
ChE 780	Special Topics	3
ChE 782	Biochemical Engineering	3
ChE 783	Air Pollution Control	3
ChE 784	Water and Waste Water Treatment	3

B. It is possible to study no more than (3) 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. Submitting a thesis of (9) credit hours

799 A Master Thesis	9 credit hours
799 B Master Thesis	6 credit hours
799 C Master Thesis	3 credit hours
799 D Master Thesis	0 credit hours

Second. **The Comprehensive Exam Program**

1. Compulsory courses, (19) credit hours, as follows:

Course No.	Course Name	C.H.
ChE 701	Mathematical Methods in Chem. Eng.	3
ChE 732	Adv. Chem. Reaction Eng.	3
ChE 741	Adv. Chem. Eng. Thermodynamics	3
ChE 762	Adv. Process Analysis and Control	3
ChE 771	Adv. Transport Phenomena	3
ChE 772	Adv. Mass Transfer	3
ChE 790	Seminar	1
		19

2. Elective courses, (15) credit hours, distributed as follows:

a. (15) credit hours selected from the following courses:

Course No.	Course Name	C.H.
ChE 702	Numerical Methods in Chem. Eng.	3
ChE 711	Adv. Materials Science	3
ChE 712	Corrosion	3
ChE 714	Colloids and Surface Chemistry	3
ChE 734	Catalysis	3
ChE 742	Applied Statistical Mechanics	3
ChE 743	Adv. Fluid Flow	3
ChE 744	Adv. Heat Transfer	3
ChE 745	Combustion	3
ChE 764	Optimization	3
ChE 773	Adv. Separation Processes	3
ChE 774	Fluidization	3
ChE 780	Special Topics	3
ChE 782	Biochemical Engineering	3
ChE 783	Air Pollution Control	3
ChE 784	Water and Waste Water 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 a required comprehensive exam.

Descriptions of the Graduate Courses
In Chemical Engineering

Ch.E. 701 Mathematical Methods in Chemical Engineering (3C, 3H)

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.

Ch.E. 702 Numerical Methods in Chemical Engineering (3C, 3H)

Advanced techniques of numerical solutions of ordinary and partial differential equations. Advanced regression techniques. Applications to chemical engineering systems.

Ch.E. 711 Adv. Materials Science (3C, 3H)

Intermolecular forces and bonding, complex molecules. Structure, formation and properties of polymers. Ferrous alloys. Semiconductors. Materials identification techniques. This course includes lab/ simulation component.

Ch.E. 712 Corrosion (3C, 3H)

Types of corrosion. Fundamental concepts in corrosion theory. Pourbaix diagrams. Experimental techniques in corrosion. Passivity, stress corrosion. Atmospheric corrosion, high temperature corrosion. Methods of corrosion control, coatings, catholic and anodic protection, inhibitors. This course includes lab/ simulation component.

Ch.E. 714 Colloids and Surface chemistry (3C, 3H)

Lyophilic and lyophobic colloids. Sedimentation and diffusion. Viscosity of dilute dispersions. Colloidal Structures in surfactant solutions. Van der waals attraction and flocculation. Steric stabilization. Electrical double layer. DLVO theory. Electrophoresis and electrokinetic phenomena. The zeta potential.

Ch.E. 721 Fertilizer Technology (3C, 3H)

Processes in the nitrogen, phosphate and potash fertilizer industries. Fertilizers waste characterization and treatment. Energy considerations. Economics of fertilizer plants. This course includes lab/ simulation component.

Ch.E. 722 Petrochemical Technology (3C, 3H)

Main raw materials and chemicals for petrochemical industries. Methods of manufacturing. Intermediate and final petrochemicals. This course includes lab/ simulation component.

Ch.E. 732 Adv. Chemical Reaction Engineering (3C, 3H)

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.

Ch.E. 734 Catalysis (3C, 3H)

Kinetic analysis of homogeneous and heterogeneous catalytic systems. Properties of porous catalysts and various measuring methods. Preparation, life, deactivation and regeneration of catalysts. Pore diffusion. Types and design principles of catalytic reactors. Selection and classification of catalysts. Industrial applications.

Ch.E. 741 Adv. Chemical Engineering Thermodynamics (3C, 3H)

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.

Ch.E. 742 Applied Statistical Mechanics (3C, 3H)

Review of the basic principles of classical and quantum mechanics. Ensembles and the partion function. Thermophysical properties of: ideal gas, low-density real gees, Dense- gases and liquids and solids. Monte-Corlo and molecular dynamic simulations of thermophysical properties.

Ch.E. 743 Adv. Fluid Flow (3C, 3H)

Nonviscous and viscous flows. Solution of Navier-Stokes equation Boundary layers. introduction to turbulence. Drag, Flow separation. Introduction to rheology.

Ch.E. 744 Adv. Heat Transfer (3C, 3H)

Multidimensional conduction. Free and forced convection. Boiling and condensation. Thermal Radiation. Thermal boundary layer analysis.

Ch.E. 745 Combustion (3C, 3H)

Fuel characteristics and selection. Basic concepts of combustion. Thermo-chemical kinetics of combustion. Flame propagation and stability. Homogeneous and heterogeneous combustion. Design of burners, furnaces and other combustors. Stack design. This course includes lab/ simulation component.

Ch.E. 762 Adv. Process Analysis and Control (3C, 3H)

Design and analysis of experiments. Data processing and analysis. Parameter estimation and model discrimination. Sampled-data control theory with applications in digital computer control systems. Nonlinear methods of dynamic analysis. Optimal control via calculus of variations and the maximum principle. This course includes lab/ simulation component.

Ch.E. 764 Optimization (3C, 3H)

Single and multi-variable search techniques. Linear programming. Constrained and non-constrained optimization. Case studies.

Ch.E. 771 Adv. Transport Phenomena (3C, 3H)

Transport properties. Unified treatment of the transport of mass, momentum and energy. This course includes lab/ simulation component.

Ch.E. 772 Adv. Mass Transfer (3C, 3H)

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. Applications.

Ch.E. 773 Adv. Separation Processes (3C, 3H)

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

Ch.E. 774 Fluidization (3C, 3H)

Principles, regimes and characteristics of fluidization. Slugging, aggregative and particulately fluidized beds. Flow pattern of gas through fluidized beds and behavior of bubbles. Mass transfer, heat transfer, catalytic and noncatalytic reactions in fluidized beds. Spouted beds. Applications.

Ch.E. 780 Special Topics (Pre req.: Department Council's approval (3C, 3H)

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

Ch.E. 782 Biochemical Processes (3C, 3H)

Nature of cell and microbial systems, transport processes and reactor engineering kinetics of biological systems, application to waste treatment, fermentation and other biochemical processes.

Ch.E. 783 Air Pollution Control (3C, 3H)

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

Ch.E. 784 Water and Waste Water Treatment (3C, 3H)

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

Ch.E. 791 Seminar (1C, 1H)

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 choice not related to his thesis. The student must, also, successfully, defend his report in an open seminar.

Ch.E. 798 Comprehensive Examination (Pre: Faculty Regulations (0C)

Ch.E. 799A M.S. Research Thesis (9C)

Ch.E. 799B M.S. Research Thesis (6C)

Ch.E. 799C M.S. Research Thesis (3C)

Ch.E. 799D M.S. Research Thesis (0C)