Course	Credit	Hour		Description
		Theoritical	Practical	
Basic				
Calculus I	3	48		Mathematical principles such as Cartesian coordinates, polar coordinate system, complex numbers, derivatives, physical and geometric applications of derivatives, limits, integral, techniques of integration, applications of integration, series, sequences, polynomial and rational functions, exponential and logarithmic functions, applications of the exponential and logarithmic functions....
Calculus II	3	48		Advanced principles of mathematics and instructions for solving equations: Parametric equations and polar coordinates, vectors in 2- and 3-dimensional Euclidean spaces, vector calculus, matrix arithmetic and determinants, linear transformations, basic linear algebra, differential equations, multivariable functions, partial derivatives, multiple integrals. Theorems of Green, Gauss (Divergence), and Stokes, cylindrical and spherical coordinates.
Differential Equations	3	48		Principles of differential equations, different ways of solving equations: First-order ordinary differential equations, second-order ordinary differential equations; series solutions of ordinary differential equations, homogeneous ordinary differential equations, variation of parameters, method of undetermined coefficients, Legendre polynomials, systems of differential equations, Laplace transform, and its applications.
Engineering Mathematics	3	48		-Fourier series and integrals, Fourier transform -Partial differential equations-Analytic Functions, conformal mapping, and different integrals
Numerical Computations	2	32		-Introduction: approximations -Systems of linear equations: solving linear systems, norms and condition numbers, accuracy of solutions, special linear systems, iterative methods -Linear least squares: normal equations, orthogonalization methods -Eigenvalues and singular values: methods for computing eigenvalues, generalized eigenvalue problems, singular values -Nonlinear equations: nonlinear equations in one dimension, systems of nonlinear equations -Interpolation and extrapolation: polynomial interpolation, piecewise polynomial methods -Numerical integration and differentiation: various quadrature methods, finite difference approximations, symbolic differentiation.
Physics I	3	48		Basic and advanced principles of mechanical physics and thermal physics.
Physics I – Lab.	1		48	Implementing theoretical principles of mechanical physics and thermal physics.
Physics II	3	48		The principles of electricity, electrical devices and electrical distribution methods.
General Chemistry I	3	48		Basic concepts, stoichiometry, gases, liquids and solids, thermochemistry, electrochemistry, atomic structure, solutions, acids and bases, chemical kinetics, chemical equilibrium, reduction and oxidation.
General Chemistry – Lab.	1		48	Independent laboratory work under the supervision of a faculty member.
Industrial Drawing	2	16	48	A review on the proper technical drawing characteristics that a chemical engineer applies to his/her work: drawing & precision measuring tools such as steel rules, calipers and micrometers; fundamentals of engineering drawing (alphabets and numbers, engineering drawing layout, types of line, scales, dimensioning, evaluation/assessment system); sections (introduction and application, symbols and positioning the cutting plane or sections, types of cross section, techniques for drawing sections, conventions used in section drawing), ...

Computer Programming	3	48		Computers, programming languages, programming in C++, mathematical functions, arithmetic expressions, ...

Principle				
Energy & Mass Balance	4	64		Principles of engineering calculations. the mass balance equation, systems of simultaneous equations, recycle, bypass, purge, properties of gases; liquids; and solids, saturation and equilibriums, partial saturation, the energy balance equation for closed and open systems, calculation of sensible heat, enthalpy change of phase transition and chemical reactions, simultaneous solution of mass and energy balance equations, psychometric chart.
Statics & Strength of Materials	3	48		Revision on scalar and vector quantities, newton's laws, systems of units, force, moment of force, couple. Various force systems and their resultants, free body diagrams, equilibrium of rigid bodies and their equations of equilibrium and reactions determination, static indeterminacy and partial constraints. Structures: trusses (method of joints, method of sections), frames and machines. Distributed forces: centers of gravity, mass, volume of rigid bodies, composite volumes, areas and lines and their centers. Beams: equations of axial and shear forces and bending moment and their diagrams for the beams under concentrated and distributed loads. Cables: flexible cables under concentrated and distributed transverse loads. Parabolic cables, catenary cables. Area moments of inertia: definitions of rectangular and polar moments of area, radius of gyration, product of area. Transfer of axes, rotation of axes, principal axes. Method of potential energy.
Organic Chemistry	3	48		-Structure and bonding, alkanes, alkenes, alkynes, aromatic compounds, halogenated organic compounds, organometallic compounds -Spectroscopy -Chemical structure, nomenclature, physical and chemical properties -Polymers and principles of polymerization.
Organic Chemistry – Lab.	1		48	Independent laboratory work in synthesis, separation and identification of organic compounds.
Thermodynamics in Chemical Engineering I	3	48		Heat and work, the first law of thermodynamics for closed and open systems, the phase behavior of pure fluids, equations of state, viral and cubic equations of state, generalized equations of state, heat effects, engines and refrigerators, the second law of thermodynamics for closed and open systems, properties of pure fluids.
Thermodynamics in Chemical Engineering II	3	48		Properties of systems of variable composition, partial properties, excess properties, and property changes of mixing, calculation of phase equilibrium for ideal gas and ideal solution, the Raoult's law, VLE calculations at low to moderate pressures, VLE calculations based on generalized equations of state, solution thermodynamics, and chemical reaction equilibriums.
Fluid Mechanics I	3	48		Foundations of fluid mechanics: Fluid and flow properties, fluids statics, basic equation of fluid flow (continuity and momentum equations), macroscopic balances, dimensional analysis, boundary layers (laminar- and turbulent flow), fully developed laminar flow. Shear stress in laminar and turbulent flow, viscous and inviscid flow. Turbulent flow in pipes and ducts, flow of incompressible non-newtonian fluids in pipes Liquid pumping systems, pump types and features, ...
Fluid Mechanics – Lab.	1		48	The fluid mechanics lab is comprised of the following set of experimental rigs: pressure drop in pipes and fittings, fluid flow measurement devices, pumps and cavitation phenomena, fixed and fluidized beds, hydrostatic pressure, drag force, gas viscosity determination, development of velocity profiles in pipes, Bernoulli's principle.
Heat Transfer I	3	48		Physical origins and rate equations of conduction, convection and radiation, conservation energy for a control volume. The heat diffusion equation, boundary and initial conditions, one and two dimensional steady-state conduction, introduction to transient conduction. The velocity and thermal boundary layers, laminar and turbulent flow, internal flow and heat transfer in circular and non-circular channels.
Heat Transfer II	3	48		Physical considerations of free convection (the governing equations, empirical correlations), combined free and forced convection. Introduction to heat transfer with phase change (boiling and condensation), physical mechanisms, boiling and condensation modes. Fundamental concepts of radiation, radiation exchange between surfaces, introduction to heat exchanger, the overall heat transfer coefficient, heat exchanger analysis: the effectiveness-NTU method, methodology of a heat exchanger calculation, compact heat exchangers.

Heat Transfer – Lab.	1		48	The heat transfer lab is comprised of the following set of experimental rigs: Temperature distribution in solids, heat transfer by convection, thermal radiation unit, heat transfer coefficient in heat exchangers (with & without fins), heat transfer coefficient in wet cooling towers, the temperature distribution in the fluid films, heating liquids, heat transfer coefficient in condensation.
Mass Transfer	3	48		Fundamentals of mass transfer, molecular diffusion in fluids, mass transfer coefficients, interphase mass transfer, equipment for gas-liquid operations and gas absorption.
Unit Operation I	3	48		Distillation, liquid-liquid extraction, and leaching.
Unit Operation II	3	48		Evaporation & crystallization, humidification, adsorption, filtration & deposition, drying and mechanical separations, dryers.
Unit Operation – Lab.	1		48	The unit operation lab is comprised of the following set of experimental rigs: distillation, liquid-liquid extraction and leaching, adsorption, evaporation & crystallization.
Processes Control I	3	48		Introduction to process control, Laplace transformation, linear system responses control and final control element systems, block diagram and closed loop transfer functions, stability, root-locus, frequency response, design of control systems implementing frequency response, NY-Quist stability analysis, control valve, ...
Kinetics & Reactor Design	4	64		Kinetics: chemical-reaction kinetics, mechanisms, chemical reaction equilibriums, interpretation of experimental kinetic data, reaction rate expression, molecular interpretation of kinetic phenomena, multiple reactions, optimization of multiple reaction systems, ... Reactor design in static and flow systems: ideal flow reactor models, non-isothermal reactors and energy considerations, deviations from ideal flow, introduction to heterogeneous catalytic reactions in flow systems, ...
Application of Mathematics in Chemical Engineering	3	48		Mathematical modeling of processing systems. Review of analytical solution of algebraic and ordinary differential equations sets, numerical integration and differentiation. Interpolation, extrapolation, curve fitting. Numerical solution of algebraic and ordinary differential equations. Solution of partial differential equations implementing combination and separation of variables.
Plant Design & Economics	3	48		Process synthesis & creation, process optimization, equipment sizing & capital cost estimation.
B.Sc. Project in Chemical Engineering	3			B.Sc. thesis : " ----------"

Specialized				
Chemistry & Kinetics of Polimerization	3	48		Molecular forces and chemical links in polymers, polymeric solutions thermodynamic, Polymers classification and polymerization mechanism, kinetics and statistic stage polymerization chemistry
Physical Chemistry of Polymers	3	48		Physical chemistry of Polymers, types of bands in polymer chemistry, Polymers chain flexibility, molecular configuration and conformation, physical states and structure of polymers, Polymer structure study methods.
Physical Chemistry of Polymers Lab.	1		48	Quality and quantitive recognition of different polymers, working with polymers molecular mass equipment viscometry, determining special weight of polymers in different methods.
Physical and Mechanical Properties of Polymers	3	48		Initial definitions related to mechanical properties, An introduction to relation of structure, properties and applications of polymers, intermolecular structure, molecular flexibility, molecular structures, studying polymers and their applications, studying fatigue, rubbing hardening, linear viscoelasticity, theory of adjustment of time and temperature, effect of heat on mechanical properties
Physical and Mechanical Properties of Polymers Lab.	1		48	measuringing softening point, MFI, hardness, tensile strength. Introduction to foaming and gels.
Polymer Rheology	3	48		Classification of non-Newtonian fluids, measuring non-Newtonian fluid specifications, Non-Newtonian materials flow in pipes and channels, Non-Newtonian heat transfer, Non-Newtonian fluids mixing, measurment instruments and viscometers.

Polymer Composites	3	48		Initial definitions, introduction to fibers and their properties, introduction to resins and their properties, common methods of preparing composites including manual, pressing, molding, filament and etc. equations in calculating the strength of composites based on the type and volume fraction of fibers.
Molecular Characterization of Polymers	2	36		Theory of Spectometry, Resonance, Special heat, enthalpy, polymer analysis from TGA, DTA, DSC. Principles of gas chromatography, Special weight, different methods of measuring special weight, application of solubility, flammability, scent, color, flame and vapor in recognizing the polymers.
Plastics Engineering	3	48		Studying thermoset and thermoplastic materials, application of heat transfer, plastic extrogen, extruder equations, injection molding machine, mixing, various methods of joining plastics to each other; forming plastic sheets including different methods of materials.
Elastomers Engineering	3	48		Definition of elastomers, elastomere mastication methods, definition and mechanism of mastication, rheology and engineering properties of elastomers, Vulcanization methods, Compounding methods, additive materials and reinforcement of elastomers, forming elastomers, elastomers analysis, elastomers recovery, chemical and physical methods of analysis and quality and quantity identification of all types of elastomer and fillers of curing materials and elastomers oils.
Principles of Polymer Reaction Engineering	3	48		Distribution of polymers molecular weight; moments of molecular weight, Step polymerization, Free radical polymerization, Emulsion polymerization, Ionic polymerization, Free radical copolymerization, Polymerization reactors design.
Polymer Processing Lab.	1		48	Injection molding machine, Compression molding machine, Thermoforming machine, extruder machine, masticating rubbers and curing, glass fibers composits.

Optional				
Professional Language for Polymers				introduction to english words related to polymers processes and polymers properties. Reading Articles about polymers.
Industrial Management				initial definitions related to industrial management, organizational chart, fixed and working capital investment costs, finance, IRR, principles of feasibility study.
Properties and Applications of Natural Polymers				mineral and organic mineral polymers, macromolecular minerals compounds, natural macromolecular compounds and their general properties, natural polymers structures.
Fibers Engineering				Diameters or width of fibers, special mass of fibers, water absorption by fibers, effect of irregularity on mechanical properties, heat properties of fibers, mechanical properties of fibers to length.

General				
English Language				A review on the English grammar, English vocabulary and reading skills.
Persian Language				A review on the prominent proses and poems of the Persian literature through the history of Iran. A review on the Persian grammar for writing.
Physical Education I		1	32	Physical education and training, including stretch exercises, running, etc.
Physical Education II		1	32	Being trained professionally in the chosen favorite sport - Volleyball.
Islamic Revolution in Iran	2	32		General Course
Analytical History of Beginning Islam	2	32		General Course

Thematic Interpretation of the Quran	2	32		General Course
Islamic Thought I	2	32		General Course
Islamic Thought II	2	32		General Course
Family Schematization and Population	2	32		General Course