Chemistry		*Curriculum Map*						
Program Outcomes: Upon completion of the program, graduates will be able to…	**Institutional Skills**	**properly use ionic, molecular, & organic chemical nomenclature.**	**analyze chemical problems and apply problem solving skills.**	**describe the atomic structure and the nature of chemical bonding.**	**recognize energy considerations in chemical reactions.**	**propose the products of chemical reactions and show mastery of stoichiometry.**	**adequately use chemical vocabulary.**	**properly use laboratory techniques, follow safety practices, and effectively communicate laboratory findings.**
Courses								
CHEM-109 College Chemistry I	12345	IRA	IR	IRA	IRA	IR	IRA	IRMA
CHEM-110 College Chemistry II	12345	RMA	R	RA	RMA	IRMA	RA	RMA
CHEM-206 Organic Chemistry I	12345	MA	MA	RMA	MA	RMA	RMA	MA
CHEM-207 Organic Chemistry II	12345	MA	RMA	R	MA	MA	RMA	MA
MATH-122 Calculus & Analytic Geometry I	123		IR		IR	R		IRA
MATH-123 Calculus & Analytic Geometry II	123		RA		R	R	R	RA
BIOL-213 Microbiology	123	IRA	IR	IR	IR	IR	IR	IRA
MATH 205 Calculus & Analytic Geometry III	123	RA	RA	RA	RA	RA	RA	RA
CHEM-210 Introduction to Biochemistry	123	MA	RMA	R	MA	MA	MA	MA
PHYS-205 General Physics I	123		IRA	IR	IR			IRA
PHYS-207 Engineering Physics I	123		IRA	IRA	IR			IRA

Mapping	
I	Introduced
R	Reinforced
M	Mastered
A	Assessed/Artifact

Essential Skills	
1	written communication
2	oral communication
3	critical thinking
4	cultural diversity
5	social responsibility

Employability Skills	
C	communication
P	problem solving
W	work ethic

CHEM 109 College Chemistry I	Curriculum Map						
Program Outcomes	properly use ionic, molecular, & organic chemical nomenclature.	analyze chemical problems and apply problem solving skills.	describe the atomic structure and the nature of chemical bonding.	recognize energy considerations in chemical reactions.	propose the products of chemical reactions and show mastery of stoichiometry.	adequately use chemical vocabulary.	properly use laboratory techniques, follow safety practices, and effectively communicate laboratory findings.
Course SLO: Students will be able to							
explain the processes involved in the scientific method, and be able to apply it to investigate natural phenomena and solve problems.	I	IR	IR	IR	IR	I	IR
explain the design and significance of experiments that led to the adoption of modern atomic theory.		R	R			I	R
recognize and interpret isotopic notation; understanding the relationship between average atomic masses and isotopic masses.	I		R			IR	
relate atomic mass to composition in terms of subatomic particles.			R				
descriptive chemistry of ionic and covalent compounds.	I	R	R			R	
describe the general properties of solutions, solubility of materials, and procedures for preparing a solution of known molarity.		R			R		
explain types of chemical reactions and perform stoichiometric calculations involving mass, moles, and solution molarity.	R				R		
explain the properties of solids, liquids, and gases.	R		R			R	

describe, define, and perform calculations involving the basic concepts of thermodynamics.		R		R		R	
conceptually and quantitatively relate spectroscopic observation of atoms to quantum mechanical theories.	R	R	R	R		R	R
explain the nature of molecular bonding and structure.	R		R			RA	
work in the laboratory in accordance with good laboratory practices.							R
gather and record qualitative and quantitative data accurately.	RA			RA		RA	R
handle and evaluate data in logical, productive, and meaningful ways.	RA		RA			RA	MA
correlate laboratory work with principle topics in Chemistry I lecture.	RA		RA			RA	MA

CHEM-110 College Chemistry II	Curriculum Map						
Program Outcomes	properly use ionic, molecular, & organic chemical nomenclature.	analyze chemical problems and apply problem solving skills.	describe the atomic structure and the nature of chemical bonding.	recognize energy considerations in chemical reactions.	propose the products of chemical reactions and show mastery of stoichiometry.	adequately use chemical vocabulary.	properly use laboratory techniques, follow safety practices, and effectively communicate laboratory findings.
Course SLO: Students will be able to							
describe the basic (colligative) properties of solutions.	R	R		R		R	R
describe the fundamentals of acid/base equilibria, including pH calculations, buffer behavior, acid/base titrations, and their relationship to electrophiles and nucleophiles.	R		R			R	MA
describe the thermodynamic and kinetic forces involved in chemical reactions which determine how much and how soon products are formed.	R	R	R	MA	IR	R	
describe the basics of electrochemistry, and the relationship of electrical parameters to thermodynamic and stoichiometric parameters.				MA	RA	R	MA
describe current bonding models for simple inorganic and organic molecules in order to predict structures and important bonding parameters.	R		R		RA	R	
describe general periodicity patterns of (organic/inorganic) molecules, and the ability to design synthetic approaches to such species.		R	R		RA	R	
describe solubility and complex ion equilibria.	R	R			MA	R	
describe the basic aspects of nuclear chemistry.			RA	RMA	R		

work in the laboratory in accordance with good laboratory practices.							**MA**
gather and record qualitative and quantitative data accurately.	**RA**	**R**				**R**	**MA**
handle and evaluate data in logical, productive, and meaningful ways.	**RMA**	**R**				**RA**	**MA**
correlate laboratory work with principal topics in College Chemistry II lecture.	**RMA**	**R**				**RA**	**MA**

CHEM-206 Organic Chemistry I	Curriculum Map						
Program Outcomes	properly use ionic, molecular, & organic chemical nomenclature.	analyze chemical problems and apply problem solving skills.	describe the atomic structure and the nature of chemical bonding.	recognize energy considerations in chemical reactions.	propose the products of chemical reactions and show mastery of stoichiometry.	adequately use chemical vocabulary.	properly use laboratory techniques, follow safety practices, and effectively communicate laboratory findings.
Course SLO: Students will be able to							
use VSEPR theory to drawn Lewis Structure.		MA	MA	MA	MA	MA	
draw resonance structures proficiently.		MA	R	MA	R	RMA	MA
predict the product of the reactions of alkanes, alkene and alkynes.	MA	MA	R	MA	R	RMA	
determine different compounds in stereochemistry.		R	R	MA	R	RMA	
predict products of reactions with free radicals.		MA	R	MA		MA	MA
predict the products of reactions of alcohols.	MA	MA	R	MA	R	RMA	
identify and predict products for SN1, SN2, E1 and E2 reactions.		MA	R	MA	R	RMA	A
explain how electron delocalization can influence reactions.			RA	MA	R	RMA	
read spectras of NMR, IR and MS to identify organic compounds.		RA				RA	MA
effectively draw mechanism of reactions.	MA	RA				RMA	MA

CHEM-207 Organic Chemistry II	Curriculum Map						
Program Outcomes	properly use ionic, molecular, & organic chemical nomenclature.	analyze chemical problems and apply problem solving skills.	describe the atomic structure and the nature of chemical bonding.	recognize energy considerations in chemical reactions.	propose the products of chemical reactions and show mastery of stoichiometry.	adequately use chemical vocabulary.	properly use laboratory techniques, follow safety practices, and effectively communicate laboratory findings.
Course SLO: Students will be able to							
read spectras of NMR, IR and MS to identify organic compounds.		RA	R	MA	MA		
explain the fundamentals of electronic structure and bonding in conjugated and aromatic systems.	MA	MA	R	MA	MA	MA	MA
discuss the fundamental electronic structure and bonding in carbonyl compounds.		RMA	R	MA	MA	MA	
understand how substituents effect on pK_a (in the case of carboxylic acids).		A	R	MA			
discuss reactivity of carbonyl compounds with both hard and soft nucleophiles (carboxylic acids, aldehydes and ketones).		MA	R	MA	MA	R	MA
explain how kinetics and thermodynamics affect carbonyl condensation reactions.		MA	R	MA	MA	MA	
predict the products of fundamental properties and reactivity of biologically important molecules (e.g. carbohydrates, amines and amino-acids).	MA	MA	R	MA	MA		
effectively predict products on reactions with organometallics.		MA	R	MA		MA	MA
effectively draw mechanism of reactions.	MA	R				MA	MA

MATH 122 Calculus & Analytic Geometry I	Curriculum Map						
Program Outcomes	properly use ionic, molecular, & organic chemical nomenclature.	analyze chemical problems and apply problem solving skills.	describe the atomic structure and the nature of chemical bonding.	recognize energy considerations in chemical reactions.	propose the products of chemical reactions and show mastery of stoichiometry.	adequately use chemical vocabulary.	properly use laboratory techniques, follow safety practices, and effectively communicate laboratory findings.
Course SLO: Students will be able to							
evaluate the limit of a function at a point both algebraically and graphically.		I		IR	R		IR
evaluate the limit of a function at infinity both algebraically and graphically.		IR		R	R		R
use the definition of a limit to verify a value for the limit of a function.							
use the limit to determine the continuity of a function.							
apply the Intermediate-Value Theorem.							
use the limit to determine differentiability of a function.		R		R	R		R
use the limiting process to find the derivative of a function.		R		R	R		R
find derivatives involving powers, exponents, and sums.		R		R			R
find derivatives involving products and quotients.							
find derivatives involving the chain rule.							
find derivatives involving exponential, logarithmic, and trigonometric functions.		R		R			R
find derivatives involving implicit differentiation.		R		R			R
use the first derivative to find critical points.							
apply the Mean-Value Theorem for derivatives.							
determine the behavior of a function using the first derivative.		R					R
use the second derivative to find inflection points.							
determine the concavity of a function using the second derivative.							

sketch the graph of the function using information gathered from the first and second derivatives.		R					R
interpret graphs of functions.		R		R			R
use the derivative to find velocity, acceleration, and other rates of change.		R		R			RA
use the derivative to find the equation of a line tangent to a curve at a given point.		R					
use optimization techniques in areas such as economics, the life sciences, the physical sciences, and geometry.		R		R	R		RA
solve related rates problems.		R		R	R		R
use Newton's Method.							
use differentials to estimate change.		R		R	R		R
find area using Riemann sums and integrals.							
express the limit of a Riemann sum as a definite integral.							
evaluate the definite integral using geometry.		R		R			R
integrate algebraic, exponential, and trigonometric functions.		R			R		RA
evaluate definite integrals using the Fundamental Theorem of Calculus.							
apply the Mean-Value Theorem for integrals.							
integrate indefinite integrals.							
integrate using substitution.							
approximate integrals using Simpson's Rule and the Trapezoidal Rule.							

MATH 123 Calculus & Analytic Geometry II	Curriculum Map						
Program Outcomes	properly use ionic, molecular, & organic chemical nomenclature.	analyze chemical problems and apply problem solving skills.	describe the atomic structure and the nature of chemical bonding.	recognize energy considerations in chemical reactions.	propose the products of chemical reactions and show mastery of stoichiometry.	adequately use chemical vocabulary.	properly use laboratory techniques, follow safety practices, and effectively communicate laboratory findings.
Course SLO: Students will be able to							
use integration to find area between curves and arc length of curves.		**R**					**R**
use integration to find volume and surface area of a surface of revolution.							
use integration to find work and force.		**R**		**R**	**R**	**R**	**RA**
use integration to find centroids.							
apply integration by parts, trigonometric substitution, & partial fractions to solve integrals.		**RA**					
identify when to use and apply L'Hopital's Rule.							
evaluate improper integrals.							
determine and compute convergence/divergence of sequences and series.							
find power series and Taylor and Maclaurin series representations of a given function and determine their intervals of convergence.							
identify conic sections and their features.							
represent curves by parametric equations, and apply the methods of calculus to them.		**R**		**R**			**RA**
represent curves by polar equations.		**R**		**R**			
determine the area of a solid formed by a polar function.		**R**					
determine the arc length of a curve of a polar function.		**R**					

BIOL 213 Microbiology	Curriculum Map						
Program Outcomes	properly use ionic, molecular, & organic chemical nomenclature.	analyze chemical problems and apply problem solving skills.	describe the atomic structure and the nature of chemical bonding.	recognize energy considerations in chemical reactions.	propose the products of chemical reactions and show mastery of stoichiometry.	adequately use chemical vocabulary.	properly use laboratory techniques, follow safety practices, and effectively communicate laboratory findings.
Course SLO: Students will be able to							
understand major contributions to the development of the field of microbiology.						I	I
describe chemical principles as they apply to microorganisms.	I	IR	IR			IR	IRA
appreciate the diversity of the microbial world.			R		IR	R	R
describe the basic morphology of prokaryotic organisms.		R	R			R	
describe how microorganisms grow and their respective nutritional requirement.	R		R	IR		R	R
describe basic metabolic pathways utilized by microorganisms.	R				IR		R
describe genetic mechanisms utilized by microorganisms and how they exchange information.	RA	R		R	R		R
describe the nature of disease and how host organisms defend against disease.		R				R	RA

	MATH 205 Calculus & Analytic Geometry III	Curriculum Map						
	Program Outcomes	properly use ionic, molecular, & organic chemical nomenclature.	analyze chemical problems and apply problem solving skills.	describe the atomic structure and the nature of chemical bonding.	recognize energy considerations in chemical reactions.	propose the products of chemical reactions and show mastery of stoichiometry.	adequately use chemical vocabulary.	properly use laboratory techniques, follow safety practices, and effectively communicate laboratory findings.
	Course SLO: Students will be able to							
VECTORS	definitions and properties associated with vectors (both 2 and 3 dimensional) and be able to perform all standard vector computations.			RA				RA
	write the equation of a sphere, a line (in 3-space) and a plane given relevant data about the structure.					RA		RA
	determine the angle between two lines or two planes.							
	determine the distance between a point and a plane or between two planes.		R					RA
SURFACES IN SPACE	forms of equations in 3-space for a cylinder, cone, ellipsoid, paraboloid, hyperboloid of one sheet and hyperboloid of two sheets.		R		RA			RA
	graph these equations as well as work applications involving these structures.							
	convert between Cartesian, cylindrical and spherical coordinates.			RA				
	graph surfaces given in cylindrical or spherical coordinates.							
	convert functions between Cartesian, cylindrical and spherical coordinate form.							
VECTOR-VALUED FUNCTION	find limits, derivatives and integrals of vector-valued functions.							
	understand the relationships concerning the position function, the velocity function and the acceleration function in space.	R			RA		RA	RA
	work applications involving projectile motion.	R	RA					
	find directed distance along a curve and the unit tangent vector of a differentiable curve.							
	find curvature, the radius of curvature and the Principal Unit Normal Vector of a plane curve.			RA				RA
	find the tangential and normal scalar components of acceleration.	RA		RA				
OF TWO OR MORE VARIABLES	determine the domain of a function in three variables.							
	bounded/unbound region, open/closed point and interior point.	R	RA	RA				RA
	find and sketch c-level curves of a two-variable function.							
	graph surfaces by hand and also using a 3-D computer grapher.		RA					RA
	find limits and analyze continuity on a surface generated by a two-variable function.							
	determine partial derivative (both first order and higher orders) for functions of two or more variables.							
	determine the differentiability and continuity of a function in two variables.							
	write a linear approximation of a function in two variables at a given point.							
	find the total differential of a function in two variables.							

FUNCTIONS	write and use chain rules for functions in two or more variables.							
	determine directional derivatives, gradient vectors and tangent planes.							
	find extrema and saddle points of functions in two variables.							
	use Lagrange multipliers to find constrained extrema of functions in two variables.							
MULTIPLE INTEGRALS	evaluate double and triple integrals.							
	use the double integral to find the area of a region.							
	use the double integral to find the moments and the centroid of a region.		R				RA	
	use double integrals to find the average value of a function on a region.							
	work a double integral either in rectangular or polar coordinate form.	R	R	RA			RA	RA
	use the triple integral to find the volume of a solid or the area of a region.	RA		RA				
	use the triple integral to find the average value of a function in space.							
	use the triple integral to find the mass, moments and centroid of a solid.	R		RA				RA
	work triple integrals in either rectangular, cylindrical or spherical coordinates.		R				RA	
	change variables in a double or triple integral using the Jacobian.							
INTEGRATION IN VECTOR FIELDS	technique for evaluating a line integral.							
	line integral to find the mass, moments and centroid of a thin rod or wire.	R					RA	
	lne integral to find the work done by a force in a vector field; also to find flow along a curve and flux across a curve.				RA			RA
	divergence and curl of a vector function.							
	Green's Theorem to convert a line integral to a double integral (and visa versa).							
	find surface integrals and flux across a surface.							
	surface integral to find the mass, moments and centroid of thin shells.		R	RA			RA	RA
	divergence theorem to evaluate surface integrals.							
	Stoke's Theorem to convert a surface integral to a line integral (or visa versa).							
	fundamental theorem of line integrals in order to evaluate line integrals which are independent of path.				RA			RA
	conservative field, potential function and exact differential form and their connections to each other.							

CHEM-210 Introduction to Biochemistry	Curriculum Map						
Program Outcomes	properly use ionic, molecular, & organic chemical nomenclature.	analyze chemical problems and apply problem solving skills.	describe the atomic structure and the nature of chemical bonding.	recognize energy considerations in chemical reactions.	propose the products of chemical reactions and show mastery of stoichiometry.	adequately use chemical vocabulary.	properly use laboratory techniques, follow safety practices, and effectively communicate laboratory findings.
Course SLO: Students will be able to							
compare and contrast the structure of DNA and RNA, explaining the difference between the constituent bases, sugars, nucleosides and nucleotides.		R	R	MA	MA		
apply Henderson-Hasselbalch equation to solve pH problems.	MA	MA	R	MA	MA	MA	MA
list and name the 20 amino acids that commonly occur in proteins and classify them according to size, chirality, polarity and charge.		RMA	R	MA	MA	MA	
list and describe the roles of each of the major components of membranes and integrate each into a working model of a generic membrane: including phospholipids, sphingolipids, cholesterol and protein.		A	R	MA			

PHYS 205- General Physics I	Curriculum Map						
Program Outcomes	properly use ionic, molecular, & organic chemical nomenclature.	analyze chemical problems and apply problem solving skills.	describe the atomic structure and the nature of chemical bonding.	recognize energy considerations in chemical reactions.	propose the products of chemical reactions and show mastery of stoichiometry.	adequately use chemical vocabulary.	properly use laboratory techniques, follow safety practices, and effectively communicate laboratory findings.
Course SLO: Students will be able to							
evaluate situations involving Physics I topics by choosing the appropriate conceptual frameworks.		**IRA**	**I**	**IR**			**IRA**
recall relevant physical models and to successfully apply these models using techniques of symbolic and numerical analysis in order to generate solutions to problems in Physics I topics.		**RA**	**R**	**R**			**RA**
think critically by utilizing problem solving techniques to evaluate and analyze context rich, multi-step problems in Physics I topics, selecting relevant information, selecting an approach to solving the problem and carrying out the analysis needed to generate and communicate solution(s).		**RA**	**R**	**IR**			**RA**
perform measurements using physical apparatus, analyze the collected data including appropriate treatment of errors and uncertainties, generate and communicate conclusions based on the data and analysis for experimental investigations in Physics I topics.		**RA**		**R**			**RA**

PHYS 207- Engineering Physics I	Curriculum Map						
Program Outcomes	properly use ionic, molecular, & organic chemical nomenclature.	analyze chemical problems and apply problem solving skills.	describe the atomic structure and the nature of chemical bonding.	recognize energy considerations in chemical reactions.	propose the products of chemical reactions and show mastery of stoichiometry.	adequately use chemical vocabulary.	properly use laboratory techniques, follow safety practices, and effectively communicate laboratory findings.
Course SLO: Students will be able to							
evaluate situations involving Engineering Physics I topics by choosing the appropriate conceptual frameworks.		**IRA**	**IA**	**IR**			**IR**
recall relevant physical models and to successfully apply these models using techniques of symbolic and numerical analysis in order to generate solutions to problems in Engineering Physics I topics.		**RA**	**RA**	**R**			**R**
think critically by utilizing problem solving techniques to evaluate and analyze context rich, multi-step problems in Engineering Physics I topics, selecting relevant information, selecting an approach to solving the problem and carrying out the analysis needed to generate and communicate solution(s).		**RA**	**RA**	**R**			**RA**
perform measurements using physical apparatus, analyze the collected data including appropriate treatment of errors and uncertainties, generate and communicate conclusions based on the data and analysis for experimental investigations in Engineering Physics I topics.		**RA**	**RA**	**R**			**RA**