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**	**IRA**	**IR**	**IRA**	**IRA**	**IRA**	**IRMA**
CHEM-110 College Chemistry II	12345	**RMA**	**R**	**RA**	**RMA**	**IRMA**	**RA**	**RMA**
CHEM-206 Organic Chemistry I	12345	**MA**	**MA**	**RA**	**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

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
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
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

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
Course SLO: Students will be able to							
Identify and differentiate between atoms, pure elements, compounds, and ions, and correlate chemical formulas with chemical names.	I		IR		IR	R	
Construct balanced chemical equations given a set of reactants and/or products, use a balanced chemical equation to solve stoichiometry problems, and analyze chemical reactions with regards to stoichiometry and thermochemistry.	IR	I		I	R	R	IR
Identify predominant species present in an aqueous solution and identify the reactants and/or products of common aqueous reactions: acid/base, redox, precipitation, etc.		IR			R	R	
Relate the periodic properties of the elements to their electronic structure using the quantum mechanical model.	R	R	R	R		R	
Apply VSEPR and Valence Bond Theory to predict the three-dimensional structure of molecules and relate macroscopic physical and chemical properties of matter to its atomic scale chemical bonding, intermolecular forces, and three-dimensional structure.	R		R			RA	
Apply the Kinetic Molecular Theory to describe an ideal gas and use the Ideal Gas Law to calculate a state variable for a given set of conditions	R	R				R	
Describe the relationships between heat, work, internal energy, and energy changes for chemical reactions and perform calculations involving these concepts.		R		RA		R	
Apply dimensional analysis and mathematical techniques to solve chemical problems, including significant figures throughout calculations in all content learning outcomes.		R			R		R
Execute laboratory skills in accordance with proper laboratory and chemical safety practices.							R
Collect, evaluate, and interpret qualitative and quantitative data from laboratory procedures in a productive and meaningful manner.	RA	RA		RA	RA	RA	MA

Course: BIOL-210 A & P	*Curriculum Map*						
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 effects of intermolecular forces in chemical systems and perform calculations involving solution concentrations and colligative properties	**R**	**R**	**RA**	**R**		**R**	**R**
Apply the concepts of chemical kinetics to evaluate rates and to describe the energetics and mechanisms of chemical reactions.	**R**	**R**		**MA**	**IR**	R	
Apply and demonstrate an understanding of equilibrium concepts to predict qualitative and quantitative properties of a chemical system	**R**	**R**		**MA**	**IR**	**R**	
Define acids and bases and evaluate strengths using chemical equilibrium concepts.		**R**			**R**	**R**	
Perform calculations involving pH, titrations, and buffers to describe acid/base and solubility equilibria.	**R**	**R**			**MA**	**R**	
Evaluate data and perform calculations involving thermodynamic quantities for a process, demonstrate the relationship between these quantities, and use the relationship to predict the spontaneity of chemical reactions.	**R**	**R**		**MA**		**R**	
Describe an electrochemical cell and utilize reduction potentials to predict the outcome of a given redox reaction.				**MA**	**RA**	**R**	**MA**
Execute laboratory skills in accordance with proper laboratory and chemical safety practices.							**MA**
Collect, evaluate, and interpret qualitative and quantitative data from laboratory procedures in a productive	**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	M	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

Course: BIOL-212 A & P II	*Curriculum Map*						
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	M		
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.
Students will be able to							
1.a.i evaluate the limit of a function at a point both algebraically and graphically		I		IR	R		IR
1.a.ii evaluate the limit of a function at infinity both algebraically and graphically		IR		R	R		R
1.a.iii use the definition of a limit to verify a value for the limit of a function							
1.b.i use the limit to determine the continuity of a function							
1.b.ii apply the Intermediate-Value Theorem							
1.b.iii use the limit to determine differentiability of a function		R		R	R		R
1.c.i use the limiting process to find the derivative of a function		R		R	R		R
2.i find derivatives involving powers, exponents, and sums		R		R			R
2.ii find derivatives involving products and quotients							
2.iii find derivatives involving the chain rule							
2.iv find derivatives involving exponential, logarithmic, and trigonometric functions		R		R			R
2.v find derivatives involving implicit differentiation		R		R			R
3.a.i use the first derivative to find critical points							
3.a.ii apply the Mean-Value Theorem for derivatives							
3.a.iii determine the behavior of a function using the first derivative		R					R
3.a.iv use the second derivative to find inflection points							
3.a.v determine the concavity of a function using the second derivative							
3.a.vi sketch the graph of the function using information gathered from the first and second derivatives		R					R
3.a.vii interpret graphs of functions		R		R			R
3.b.i use the derivative to find velocity, acceleration, and other rates of change		R		R			RA
3.b.ii use the derivative to find the equation of a line tangent to a curve at a given point		R					
3.b.iii use optimization techniques in areas such as economics, the life sciences, the physical sciences, and geometry		R		R	R		RA
3.b.iv solve related rates problems		R		R	R		R
3.b.v use Newton's Method							
3.b.vi use differentials to estimate change		R		R	R		R
4.a find area using Riemann sums and integrals							
4.b express the limit of a Riemann sum as a definite integral							
4.c evaluate the definite integral using geometry		R		R			R
4.d integrate algebraic, exponential, and trigonometric functions		R			R		RA
4.e evaluate definite integrals using the Fundamental Theorem of Calculus							
4.f apply the Mean-Value Theorem for integrals							
4.g integrate indefinite integrals							
4.h integrate using substitution							
4.i 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.**
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			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 FUNCTIONS							
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				
FUNCTIONS 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							
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	
line 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-Hasselbach equation to solve pH Problems	**MA**	**MA**	**R**	**MA**	**MA**	**MA**	**MA**
List and name the 20 aminoacids 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, shingolipids, 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
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
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