Title: ***Topics* in *Applied College Mathematics (TAC.Math)***
Rev. 10-1-08

Catalog Course Description: (3 Credits) *[Course may be increased to 4 Credits by a more comprehensive selection of subtopics, skills and objectives from the suggested categories]*

This course is designed to expose the student to a wide range of general mathematics. Problem Solving and Critical Thinking skills, along with the use of technology, will be emphasized and reinforced throughout the course as the student becomes actively involved solving applied problems. Topics to be covered include: Number Theory and Systems, Functions and Modeling, Finance, Geometry and Measurement, Probability and Statistics, and selected subtopics related to the student's major field of study.

(Pre-Requisite: Competency as determined by the mathematics placement exam, or satisfactory completion of an appropriate developmental math course, or permission of an authorized college official)

Major Topics	Competencies	Suggested Skills and Objectives by Subtopic (Instructor's Choice as Necessary to Achieve Competencies)
Introduction to Problem-Solving and Critical Thinking (to be applied throughout the exploration of all topic areas)	Students will understand the problem-solving process and build a positive disposition towards problem-solving and mathematics	***Problem-Solving Process*** • Describe both inductive and deductive reasoning and demonstrate examples of informal proofs • Use the problem-solving process (i.e., Polya's four phases – understanding the problem, devising a plan, carrying out the plan, and looking back) and problem-solving heuristics (e.g., guess and check, drawing a diagram) to solve a variety of problems ***Habits of the Mind***

	Students will develop the habits of mind and confidence needed to solve increasing complex mathematical tasks and problems unique to their environments	• Develop a variety of habits of the mind (e.g., persistence, thinking flexibly, risk taking, finding humor, thinking interdependently - ref. www.habitsofmind.org/what_are_the_habits_of_mind.htm) .
Number Theory/Number Systems	Students will understand the axiomatic development of the real and complex number systems, their properties and the relationships between their properties Students will apply, explain, and justify concepts in the base-10 system and other systems of numeration and demonstrate a capacity to use models to explore and explain these relationships	***Theory of Arithmetic Processes (review as necessary)*** • Define integers, rational numbers, irrational numbers and real numbers • Identify properties of real numbers • Add/Subtract/Multiply/Divide real numbers • Use the order of operations agreement • Use properties of exponents • Convert between scientific notation and decimal notation • Perform computations using scientific notation • Solve applied problems using scientific notation • Solve applied problems involving percentages • Display an understanding of various mathematical theorems and processes (e.g., division algorithm, infinitely many primes, Sieve of Eratosthenes) ***Systems of Numeration*** • Positional systems of numeration • Early numeration systems • Change numerals in bases other than 10 to base 10 • Change base 10 numerals to numerals in other bases • Computation in other bases
Algebra: Functions &	Students will understand	***Functions & Family of Functions***

Modeling	the language of functions and graphs, the concept of rate of change for both linear and non-linear functions, and transformations of functions	- Plot points and graph equations in the rectangular coordinate system - Use f(x) notation and graph functions - Interpret slope as a rate of change in an applied problem - Graph a wide variety of linear and non-linear functions and use these functions to model real-world situations
	Students will develop a variety of algebraic techniques necessary for algebraic problem solving and modeling	*Regression Analysis* - Plot data points and write the equation of the line that models the data - Use technology to find the equation of a regression line - Use technology to find a linear correlation coefficient - Describe the significance of a positive/negative correlation coefficient - Create a scatter plot and use the shape to determine the best model
	Students will recognize describe, and generalize a wide variety of patterns (e.g., linear, quadratic, exponential, trigonometric) and construct a variety of mathematical models (e.g., symbolic, graphic, numeric, verbal) to analyze and interpret real-world situations, including fitting functions to scatter plots and using those functions for prediction and analysis	*Finance* - Calculate simple interest - Use compound interest formulas - Use the future value formulas - Calculate present value - Calculate interest on a credit card bill - Calculate a monthly payment for a consumer loan - Calculate a payoff amount on a consumer loan - Understand mortgage options - Compute the monthly payment and interest costs for a mortgage
	Students will develop financial literacy and apply it to situations unique to their environments	
		Equations

		• Solve applied problems involving first degree equations • Solve applied problems involving rates, ratios and proportions • Solve applied problems involving direct and inverse variation
Geometry & Measurement	Students will understand that concepts of measurement can be applied in multiple dimensions and understand measurable attributes of objects and the units, systems and processes of measurement Students will understand that logical and mathematical reasoning can be used effectively to problem-solve in order to arrive at appropriate solutions and to develop mathematical arguments about geometric relationships Students will understand	***Measurement*** • Understand and use metric prefixes • Convert units within the metric system • Convert units with the U.S. Customary system • Use dimensional analysis to change to and from the metric system (length, area, volume, weight, and temperature) • Use area formulas to compute the areas of plane regions and solve applied problems • Use volume formulas to compute the volumes of 3-dimensional figures and solve applied problems • Use trigonometric ratios to solve applied problems ***Review of Euclidean Geometry (as necessary)*** • Understand points, lines, and planes as the basis of geometry • Solve problems involving angle measures, angle relationships in triangles, the Pythagorean Theorem • Solve problems involving a polygon's perimeter ***Introduction to Non-Euclidean Geometry*** • Demonstrate an understanding of basic concepts in

	that geometry connects to the other strands of mathematics and to other disciplines Students will demonstrate knowledge of the role of a parallel postulate in the development of non-Euclidean geometry	non-Euclidean geometry such as spherical or hyperbolic geometry (e.g., the shortest distance between two points, the sum of the angles in a triangle)
Probability & Statistics	Students will understand the four components of the statistical process: formulating questions, collecting data, analyzing the data, and interpreting the results Students will understand that probability is a tool for statistics (the teaching of probability should be integrated with the teaching of statistics) Students will develop the critical skills necessary to evaluate statistical representations Students will understand the nature of variability in	***Counting Techniques & Probability*** • Use the Counting Principle • Evaluate factorial expressions • Solve problems using combination and permutation formulas • Compute theoretical and empirical probability • Find a conditional probability • Find the probability of successive events • Understand and use odds ***Analyzing & Interpreting Representations & Distributions of Data*** • Organize and present data • Determine mean, median, mode and midrange for a data set • Determine the range and standard deviation for a data set • Recognize characteristics of normal distributions • Understand and use the Empirical Rule • Interpret percentiles and quartiles • Solve applied problems involving normal distributions

each of the four components of the statistical process (anticipating variability when formulating questions, designing data collection methods that acknowledge variability, using distributions to analyze data, and allowing for variability when interpreting results)	***Statistical Inference*** • Use and interpret margins of error • Use and interpret sampling distributions • Develop hypotheses and informally test those hypotheses through simulations

Attribution ~ The content and the recommended pedagogical approach to the delivery of this course were influenced by: *Habits of Mind* – Association for Supervision and Curriculum Development; *Crossroads In Mathematics: Standards for Introductory College Mathematics before Calculus* – American Mathematical Association of Two-year Colleges; and *Guidelines for Assessment and Instruction in Statistics Education: College Report.*

<u>Textbooks Recommended for Instructor Consideration:</u>

➢ Angel, Abbott & Runde – <u>Survey of Mathematics With Applications</u>
➢ Blitzer – <u>Thinking Mathematically</u>
➢ Burger & Starbird – <u>Heart of Mathematics: An Invitation to Effective Thinking</u>

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