MAT 160      PRE-CALCULUS

CREDIT HOURS:  4.0
EQUATED HOURS:  4.0
CLASS HOURS:  4.5
PREREQUISITE:  MAT 030 or placement
REQUIRED TEXTS:  Dugopolski: Pre-calculus, 3rd Edition, Addison Wesley, 2005

DESCRIPTION:  This course provides essential concepts for the study of Calculus. Topics: Concepts in algebraic and transcendental (exponential logarithmic and trigonometric) functions; inverse functions, graphs of functions. Equations, inequalities, theory of equations and applications.

LEARNING OUTCOMES:

Students should understand the concepts of functions and be able to apply their comprehension to solve mathematical and application problems after they achieve proficiency in the following:

• Performing computations involving functions, inverse functions and relations.
• Sketching graphs of algebraic and transcendental functions using transformations.
• Using the graphs of algebraic functions to solve the corresponding equations and inequalities.
• Understanding trigonometric relationships and be able to derive trigonometric identities.
• Solving exponential, logarithmic and trigonometric equations.
• Solving application problems including exponential, logarithmic and trigonometric functions.

EXAMINATIONS:  A minimum of three partial tests and a comprehensive final examination.

I. RELATIONS AND FUNCTIONS

1) Function

2) Graph of Relation & Functions
XY-Plane, Graph of linear, quadratic, radical, absolute value, step and piece-wise functions. Vertical line test.

3) Families of Function
Graphing by transformation: Reflections, Translations, Vertical, Horizontal. Symmetry with respect to the x and y axis, emphasize odd & even functions.

4) Operation of Functions
Emphasize composite functions & decompose a composite function. Addition, subtraction, multiplication, division.

5) Inverse Functions
Horizontal line test, finding inverse functions. Composite function of inverses \( f[g(x)] = x \)
One to one functions.

6) Constructing Functions

7) Quadratic Function, Inequalities and Equations.
Use the graph of \( y=ax^2+bx+c \) to explain the solution of equation is the intersection point with x-axis \( (y=0) \) and the solution of inequality is actually finding when the graph lies above \( (y>0) \) or below \( (y<0) \) x-axis. The extreme is the y coordinate of the vertex.

III. POLYNOMIAL AND RATIONAL FUNCTIONS

1) Polynomial Functions

2) Graph of Polynomial
Intercepts, symmetry, Asymptotes (vertical, & Rational Functions. horizontal, oblique). Use rough graph to solve Inequalities.

3) Rational Functions
Synthetic Division and Asymptotes
IV. EXPONENTIAL AND LOGARITHMIC FUNCTIONS

1) Exponential Function
   Definition, Properties, Graphs.

2) Logarithmic Function
   Definition, Properties, Graphs. Emphasize for each exponential (logarithmic) expression there exist equivalent logarithmic (exponential) expression.

3) Rules of Logarithm
   \[ \log(a + b) \neq \log(a) + \log(b) \]

4) Equations and Applications
   Solving Exponential and Logarithmic Equations. Application of exponential & logarithmic equations to solving, compound interest, growth and decay and other problems.

V. Right Triangle Trigonometry & Eight Basic Identities

1) Introduce six trigonometry identities by ratios by three sides of a right triangle.

2) Measurements of Angles
   Conversion of angles measured in degrees and Radians.

3) Definitions of Trig. Functions when angles are in standard position
   Complementary and co-terminal angles. Signs of Trig. functions in different quadrants. Reference angles \( R(x) \). \( \text{Trig}(x) = \pm \text{Trig } R(x) \).

4) Graphs of Trig. Functions. Inverse Trig. Functions
   Emphasize \( \sin x, \cos x \& \tan x \) includes \( y = A \text{trig.}(bx + c) \)

5) Trigonometric Identities.
   Requires students to know how to derive identities by using:
   \[ \cos(x + y) = \cos x \cos y - \sin x \sin y \]

6) More Identities, verifying identities and Trig. Equations
   Trigonometric Functions of Sums and Differences of Angles
   Solving First and Second Degree Trigonometric Equations
   Laws of Sine and Cosine- Application on Solving Triangles
   Double Angle and Half Angle Formulas