HOSTOS COMMUNITY COLLEGE
DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

MAT 160 PRE-CALCULUS

CREDIT HOURS: 4.0

EQUATED HOURS: 4.0

CLASS HOURS: 4.5

PREREQUISITE: MAT 150 or placement

REQUIRED TEXTS: Ratti & McWaters. Precalculus: A Unit Circle Approach, 2nd Edition, Pearson.
ISBN-10: 032182539X
ISBN-13: 9780321825391

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.

EXAMINATIONS: A minimum of four partial tests (suggested 60%-70%) and a comprehensive departmental final examination (suggested 30%-40%)

GRADES: A, A^-, B^+, B, B^-, C^+, C, D, I, F.

MAT 160 Student Learning Outcomes:

1. Interpret and draw appropriate inferences about functions and their properties from quantitative representations such as graphs of polynomials, logarithmic, exponential, rational and trigonometric functions.
2. Use algebraic, numerical and graphical methods to solve mathematical problems including representing functions as graphs and their associated composite and inverse functions.
3. Represent quantitative problems expressed in natural language in suitable algebraic, functional and graphical form.
4. Effectively communicate solutions to mathematical problems in written, graphical or equation form.
5. Evaluate solutions to problems and verify the validity of graphs of functions for reasonableness by inspection.
6. Apply mathematical methods to problems in other fields of study such as Physics, Economics and Chemistry

Pathways Learning Outcomes:

Mathematical and Quantitative Reasoning:

MAT 160 will meet all the following Pathways Learning Outcomes from "Mathematical and Quantitative Reasoning". A student will:

1. Interpret and draw appropriate inferences from quantitative representations, such as formulas, graphs, or tables.
2. Use algebraic, numerical, graphical, or statistical methods to draw accurate conclusions and solve mathematical problems
3. Represent quantitative problems expressed in natural language in a suitable mathematical format.
4. Effectively communicate quantitative analysis or solutions to mathematical problems in written or oral form.
5. Evaluate solutions to problems for reasonableness using a variety of means, including informed estimation.
6. Apply mathematical methods to problems in other fields of study.

Flexible Common Core:

MAT 160 will meet all the following Pathways Learning Outcomes from "Flexible Common Core". A student will:

1. Gather, interpret, and assess information from a variety of sources and points of view.

2. Evaluate evidence and arguments critically or analytically.

3. Produce well-reasoned written or oral arguments using evidence to support conclusions

4. Demonstrate how tools of science, mathematics, technology, or formal analysis can be used to analyze problems and develop solutions.

5. Articulate and evaluate the impact of technologies and scientific discoveries on the contemporary world, such as issues of personal privacy, security, or ethical responsibilities.

6. Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the scientific world, including, but not limited to computer science, history of science, life and physical sciences, linguistics, logic, mathematics, psychology, statistics, and technology-related studies.

LEARNING OUTCOMES ASSESSMENT TOOLS:

SLO#1 & PLO#1:

- Unit Test #1: Differentiate between functions and relations, determine symmetry, locate asymptotes and perform reflections and translations of graphs of functions.
- Unit Test #2: Locate horizontal, vertical and oblique asymptotes of rational functions by examining their graphs.
- Unit Test #3: Evaluate and graph exponential and logarithmic functions.
- Unit Test #4: Identify the graphs of all six trigonometric functions in standard position. Determine the period, amplitude and phase shift of a trigonometric function from its graph.
- Departmental Final Exam: Cumulative

SLO#2 & PLO#2:

- Unit Test #1: Use algebraic and numerical methods to determine the inverse of a function. Find the composition of functions. Verify inverses by composition and by reflection. Determine the graph of a function through use of translation and reflection. Determine a table of values for a function or relation.
- Unit Test #2: Use algebraic methods to determine if rational functions have asymptotes and if so, what type. Use algebraic and numerical methods to graph exponential and logarithmic functions. Compute inverses of rational functions. Determine a table of values for polynomial and rational functions.
- Unit Test #3: Compute the inverses of exponential and logarithmic functions. Determine a table of values for exponential and logarithmic functions.
- Unit Test #4: Determine a table of values for a trigonometric function. Graph all six trigonometric functions in standard position. Graph a trigonometric function with different amplitude, phase shift and period.
- Departmental Final Exam: Cumulative

SLO#3 & PLO#3 & FCC#1:

- Unit Test #1: Translate word problems involving direct and indirect variation into appropriate mathematical language.
- Unit Test #2: Express problems using exponential and logarithmic functions.
- Unit Test #3: Convert word problems into appropriate exponential and logarithmic functions.
- Unit Test #4: Convert word problems into appropriate trigonometric functions.
- Departmental Final Exam: Cumulative

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SLO#4 & PLO#4:

- Unit Test #1: Express solutions to problems using appropriate written, graphical or analytic form.
- Unit Test #2: Communicate solutions to rational, exponential and logarithmic problems in accurate and appropriate form which may be written, graphical or analytic.
- Unit Test #3: State solutions to exponential and logarithmic problems using graphs, value or table of values.
- Unit Test #4: State solutions to trigonometric problems using an appropriate graph, value or table of values.
- Departmental Final Exam: Cumulative

SLO#5 & PLO#5:

- Unit Test #1: Use the vertical and horizontal line tests to examine graphs to determine if they represent functions or relations.
- Unit Test #2: Graph asymptotes and asymptotic behavior in a clear manner. Identify when a graph does not correspond to the given function.
- Unit Test #3: Graph exponential and logarithmic functions. Identify inverse relationships between the functions.
- Unit Test #4: Express trigonometric values in appropriate units. Inspect trigonometric graphs for appropriate ranges.
- Departmental Final Exam: Cumulative

SLO#6 & PLO#6 & FCC#6:

- Unit Test #1: Use percent mixture formulas to solve application problems in Chemistry.
- Unit Test #2: Describe application problems in Business, Social Sciences, Biology and Chemistry involving growth and decay using exponential and logarithmic functions.
- Unit Test #3: Apply exponential and logarithmic models to problems in Economics, Biology and Chemistry.
- Unit Test #4: Apply trigonometry to problems in Physics.
- Departmental Final Exam: Cumulative.

COURSE OUTLINE
MAT 160 PRECALCULUS

I. RELATIONS AND FUNCTIONS

1) Review: Set Notation, Functions, Vertical Line Test, Domain and Range, Operations on Functions, Composition of Functions, Inverse Functions, One-to-one Functions **2 sessions**

2) Graphs of radical, absolute value, step and piece-wise defined functions Graph of linear, quadratic, radical, absolute value, step and piece-wise functions. **1 session**

3) Graphing Functions by Transformation: Horizontal Translations, Stretching, Shrinking, Reflections and Vertical Translations; Symmetry with Respect to the x-axis, y-axis and the Origin; Odd & Even Functions **2 sessions**

4) Constructing Functions; Variations; Application of Functions to Physics, Economics, Chemistry and Geometry **1 session**

5) The Difference Quotient **1 session**

6) Review of Quadratic Functions; Quadratic Inequalities **1 session**

7) Review for Test **1 session**

Test #1 **1 session**

II. POLYNOMIAL AND RATIONAL FUNCTIONS

1) Zeros of Polynomials, Synthetic and Long Division, Remainder Theorem, Factor Theorem, Fundamental Theorem of Algebra and the Rational Zero Theorem **2 sessions**

2) Multiplicity, *n*-Root Theorem, Conjugate Pairs, Descartes' Rule of Signs, Bounds on Roots* **1 session**

3) Graphs of Polynomial Functions, Intercepts, Symmetry, Asymptotes, Leading Coefficient Test **2 sessions**

4) Rational Functions, Horizontal, Vertical and Oblique Asymptotes, Graphs of Rational Functions; Rational Inequalities **2 sessions**

5) Review for Test #2 **1 session**

Test #2 **1 session**

III. EXPONENTIAL AND LOGARITHMIC FUNTIONS

1) Exponential Functions: Definition, Properties and Graphs; Applications of Exponential Functions **2 sessions**

2) Logarithmic Functions: Definition, Properties, Graphs; Conversion between Exponential and Logarithmic Forms; Some Basic Equations **2 sessions**

3) Rules of Logarithms: Products, Quotients, Powers and Change of Base **1 session**

4) Equations and Further Applications of Exponential and Logarithmic Functions: Solving Exponential and Logarithmic Equations, Populations Growth, Radioactive Decay, Compound and Continuously Compound Interest, Newton's Law of Cooling* **2 sessions**

5) Review for Test #3 **1 session**

Test #3 **1 session**

IV. TRIGONOMETRY

1) Review of Angle Measurements: Degrees and Radians; Review of the Six Trigonometric Functions; Review of Right Triangle Trigonometry, Special Angles and Solving Right Triangles **2 sessions**

2) Reference Angles; Unit Circle Definitions of Trigonometric Functions; Trigonometric Values for Special Angles on the Unit Circle; Evaluating Inverse Trigonometric Functions **1 session**

3) Graphs of Sine and Cosine Functions: Amplitude, Frequency, Period, Phase Shifts and Vertical Translations. Introduction to Simple Tangent Graphs **2 sessions**

4) Basic Trigonometric Identities; Odd and Even Identities; Verifying Identities; Sum and Difference Identities; Double Angle and Half Angle Identities **2 sessions**

5) Solving Trigonometric Equations **1 session**

6) Law of Sines and Law of Cosines with Applications to Solving General Triangles and Using Bearing Angles in Word Problems **2 sessions**

5) Review for Test #4 **1 session**

Test #4 **1 session**

Review for Comprehensive Departmental Final Exam **2 sessions**

Comprehensive Departmental Final Exam

Note that this syllabus is a suggested time line only. Instructors are responsible for covering all of the material in the syllabus but they may do so at their own pace.