**COLLEGE OF LAKE COUNTY**

Departmental Course Outline

**MTH 144 PRECALCULUS 5 / 0 5**

Prefix & No. Course Title Lec / Lab Cr. Hrs.

**COURSE DESCRIPTION:**

This course is primarily for students who intend to take MTH 145 Calculus and Analytic Geometry I. Precalculus topics include, but are not limited to: polynomial, rational, exponential, logarithmic, and trigonometric functions and equations, trigonometric identities, applications of trigonometry, systems of nonlinear equations and inequalities, conic sections, and sequences and series.

**NOTE:** Use of a specific graphing calculator will be integrated throughout the course. Contact EMPS Division Office for details. Students who earn a grade of C in MTH 108 must complete the yearlong sequence of MTH 122 College Algebra and MTH 123 Trigonometry as a prerequisite for MTH 145 Calculus and Analytic Geometry I.

*Prerequisite:* Geometry proficiency **and** MTH 108 (B or better) **or** appropriate score on the CLC Math Placement Test , Math ACT, or Math SAT.

**COURSE COMPETENCIES/OBJECTIVES:**

Upon completion of this course, the student should be able to:

1. *Create graphs using linear transformations.*
2. *Create graphs of non-linear functions.*
3. *Solve non-linear inequalities.*
4. *Analyze polynomial and rational functions.*
5. *Solve exponential and logarithmic equations.*
6. *Construct and solve exponential and logarithmic application problems.*
7. *Evaluate trigonometric values at all special angles and their multiples without a calculator.*
8. *Construct graphs of trigonometric functions using linear transformations.*
9. *Examine inverse trigonometric functions including their domain and range.*
10. *Solve right triangles using the definitions of trigonometric functions.*
11. *Solve oblique triangles using the Law of Sines or Law of Cosines.*
12. *Establish trigonometric identities.*
13. *Solve trigonometric equations.*
14. *Solve real world problems using trigonometry.*
15. *Analyze and graph polar equations.*
16. *Solve non-linear systems of equations and inequalities.*
17. *Investigate conic sections.*
18. *Examine sequences and series.*

**GENERAL LEARNING OBJECTIVES**

1. *Critical Thinking – Use of scientific methods and other models or inquiry to define problems, access, evaluate, integrate, and document information and develop logical arguments with evidence.*
2. *Written Communication – Present information and ideas effectively in various contexts and formats.*
3. *Oral Communication – Present information and ideas effectively in various contexts and formats.*
4. *Quantitative Literacy – Use appropriate quantitative methods to compute, reason, and solve problems.*
5. *Technology – Use technology appropriately and effectively.*

**CALCULATOR COMPETENCIES:**

Upon completion of this course, the student should be able to use the required calculator to:

1. *Polynomials*

* *Graph polynomials*
* *Find real zeroes to verify algebraically*

1. *Non-Linear Systems of Equations*

* *Solve graphically*

1. *Sequences & Series*

* *Generate terms of a sequence using Lists*
* *Input and graph sequences using the graphing editor*
* *Find the sum of finite series*

1. *Trigonometric Angles*

* *Convert angles from decimal degree measure to degrees, minutes and seconds and vice-versa.*

1. *Trigonometric Functions*

* *Graph the six trigonometric functions utilizing an appropriate window and interpreting asymptotes appropriately.*
* *Perform transformations of the sinusoidal functions by adjusting the appropriate window variables.*
* *Evaluate the six trigonometric functions for non-special angles in both degree and radian mode.*

**COURSE OUTLINE:**

|  |  |
| --- | --- |
| **SECTION / TOPIC**  **1. Graphs** | **HOURS** |
| **2. Functions and Their Graphs** |  |
| Cover Section 1.5 (circles) and parts of 2.1-2.3: difference quotient, average rate of change, slope of the secant, review domain and range, cover even/odd properties, definition of increasing/decreasing | 3 |
|  |  |
|  |  |
| 2.4 Library of Functions; Piecewise-defined Functions | 1 |
| 2.5 Graphing Techniques: Transformations | 2 |
| * 1. Mathematical Models: Building Functions |  |
|  |  |
|  |  |
| **4. Polynomial and Rational Functions** |  |
| 4.1 Polynomial Functions and Models (only real zeros and their multiplicities) | 1 |
| 4.2 The Real Zeros of a Polynomial Function (only real zeros and connection to how a polynomial  factors) | 1 |
| 4.3 Complex Zeros: Fundamental Theorem of Algebra (only conjugate pairs theorem) | 1 |
| 4.4 Properties of Rational Functions | 1 |
| 4.5 The Graph of Rational Functions | 2 |
| 4.6 Polynomial and Rational Inequalities | 1.5 |
|  |  |
| **5. Exponential and Logarithmic Functions** |  |
| Review 5.1-5.5 Composite Functions, One-to-One Functions, Inverse Functions (finding inverses of functions beyond basic linear and cube root functions), Exponential Functions, Logarithmic Functions, Properties of Logarithms) | 3 |
|  |  |
|  |  |
| 5.6 Logarithmic and Exponential Equations | 2 |
| 5.8 Exponential Growth and Decay Models: Newton's Law: Logistic Growth and Decay Models | 1.5 |
| \*\*Instructor may provide formulas for Newton’s law of cooling/warming and logistic growth  **6. Trigonometric Functions** |  |
| 6.1 Angles and their Measure | 1 |
| 6.2 Trigonometric Functions: Unit Circle Approach | 1 |
| 6.3 Properties of the Trigonometric Functions | 1 |
| 6.4 Graphs of the Sine and Cosine Functions | 2 |
| 6.5 Graphs of the Tangent, Cotangent, Cosecant, and Secant Functions | 2 |
| 6.6 Phase Shift: Sinusoidal Curve Fitting | 1.5 |
| 1. **Analytic Trigonometry** |  |
| 7.1 The Inverse Sine, Cosine, and Tangent Functions | 2 |
| 7.2 The Inverse Trigonometric Functions (Continued) | 2 |
| 7.3 Trigonometric Equations | 2 |
| 7.4 Trigonometric Identities | 2 |
| 7.5 Sum and Difference Formulas | 1 |
| 7.6 Double-angle and Half-angle Formulas  \*\*For the tangent function only, instructor may provide double angle and sum and difference identities | 1 |
| * 1. Product-to-Sum and Sum-to-Product Formulas   \*\*Instructor may provide product to sum and sum to product identities | 1 |
| 1. **Applications of Trigonometric Functions** |  |
| 8.1 Right Triangle Trigonometry: Applications | 1 |
| 8.2 The Law of Sines | 2 |
| 8.3 The Law of Cosines | 2 |
| * 1. Area of a Triangle | 1 |
| 1. **Polar Coordinates; Vectors** |  |
| 9.1 Polar Coordinates | 1 |
| 9.2 Polar Equations and Graphs | 2 |
| 9.3 The Complex Plane: De Moivre's Theorem | optional |
|  |  |
|  |  |
| 1. **Analytic Geometry** |  |
| 10.2 The Parabola | 1.5 |
| 10.3 The Ellipse | 2 |
| 10.4 The hyperbola | 2 |
| 1. **Systems of Equations and Inequalities** |  |
|  |  |
| 11.6 Systems of Nonlinear Equations | 2 |
|  |  |
| 1. **Sequences; Induction; the Binomial Theorem** |  |
| 12.1 Sequences  \*\*Instructor may provide annuity and amortization formulas, as well as formulas for sums of sequences of the form | 2 |
| 12.2 Arithmetic Sequences | 1.5 |
| 12.3 Geometric Sequences: Geometric Series | 2 |
| 12.5 The Binomial Theorem | 1.5 |
| Total Instruction | 64 |
| Testing / Leeway / Group Projects | 11 |
| Total Hours | 75 |

**COURSE REQUIREMENTS:**

Text: Sullivan & Sullivan, Precalculus Enhanced with Graphing Utilities, 7e, Pearson, 2017

Calculator: TI-83 or TI-84 graphing calculator

**MEANS OF STUDENT EVALUATION:**

The precise means of student evaluation will vary from one instructor to the next. However, the student can expect to be evaluated by, in addition to written tests (see notes about assessments below) and a written timed two hour comprehensive final examination, all or some of the following: classroom responses; homework; quizzes; group work; proofs; presentations; and projects. Expect the final exam to be of greater weight than an hour exam. **A STUDENT MUST TAKE THE COMPREHENSIVE FINAL EXAMINATION IN ORDER TO EARN A PASSING GRADE IN THIS COURSE.**

**NOTES ABOUT ASSESSMENTS:**

1. **Take-Home Exams:** Take-home exams should be used sparingly in a transfer level class, if at all. If a take-home exam is utilized, the questions should be of a non-standard and challenging nature. Under no circumstances should any portion of the final exam be given as a take-home exam.
2. **Written Exams:** Exams in this course are written exams done in a proctored environment. The expectation is for each instructor to write his or her own unique exams. Do not use exams from a printed test bank. If a test generator is utilized for making an exam, use short answer questions only. Multiple choice exams are strongly discouraged in mathematics classes.
3. **Calculator Use:** In this course, some of the content is to be assessed without the use of a calculator. For example, students are to be able to evaluate all trigonometric functions at special angles in both degrees and radians without the use of a calculator.
4. **No Aids:** It is expected that students will be able to demonstrate mastery of the objectives of the course without any aids on assessments such as books, notes, note cards, cheat sheets, or other similar aids. The instructor may provide:
5. An obscure formula in an application may be given within the context of the problem.
6. Formulas for Newton’s law of cooling/warming, logistic growth, sums of sequences in the form , annuity, and amortization.
7. For the tangent function only, double angle and sum and difference identities.
8. Product to sum and sum to product identities.

**ADDITIONAL COMMENTS:**

This course is designed to provide the student with a university parallel course in the traditional mathematical sequence required of students in mathematics, the physical sciences, engineering, etc. This is a five (5) hour course which stresses manipulative skills, applications, and proofs.

\*It is expected that the fundamental identities are to be memorized by the student. Half-angle identities are optional. (i.e. students planning on proceeding to MTH 145, Calculus and Analytic Geometry, are expected to know the reciprocal, Pythagorean, negative angle, sum, difference, and double-angle identities.)

**SEMESTERS TO BE OFFERED:**

Spring, Summer & Fall

**Course Weighting Guidelines**

MTH 101, 102, 108, 114, 115, 117, 118, 122, 123, 144, 145, 146

* **Final Exam:** 20 – 30%
* **In-class, proctored assessments:** 50%
  + Quizzes
  + Exams
  + Tests
* **Other graded work:** 0 – 30%
  + Homework
  + Projects
  + Take-home quizzes
* **Other:**  5%
  + Attendance
  + Participation
  + Bonus points/Extra credit

**Additional Notes**

* Do not only give a midterm and a final. Keep total exam time approximately equal to the number of credit hours. For example: A 4-credit class should have about 4 class hours of testing time (plus 2 hours for the final exam).
* If giving points for attendance and/or participation, keep them to a minimum.
* Extra credit should be truly EXTRA and beyond the normal scope. Extra credit should not influence a grade significantly. Please keep extra credit opportunities minimal.
* Graded work that is missing should earn a score of 0 points or 0%.
* No predominately multiple-choice exams.
* Take-Home Exams - Under no circumstances should a final exam be given as a take-home exam.
  + **Developmental Classes**: Take-home exams are strongly discouraged in developmental classes.
  + **Transfer-level classes:** Take-home exams should be used sparingly in a transfer level class, if at all. If a take-home exam is utilized, the questions should be of a non-standard and challenging nature.
* Written Exams: Written exams should be taken in a proctored environment. Retakes should not be given on exams. The expectation is for each instructor to write his/her own unique exams. Do not use exams from a printed test bank. If a test generator is utilized for making an exam, use short-answer questions only. It is not appropriate to give on-line exams.
* Final exams must be comprehensive and of greater weight than an hour exam.
* No Aids: It is expected that students will be able to demonstrate mastery of the objectives of the course without any aids on assessments such as books, notes, note cards, cheat sheets, or other similar aids. The instructor may provide an obscure formula in an application within the context of the problem.