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SAN DIEGO COMMUNITY COLLEGE DISTRICT
CITY, MESA, AND MIRAMAR COLLEGES
ASSOCIATE DEGREE COURSE OUTLINE

SECTION I

SUBJECT AREA AND COURSE NUMBER: Mathematics 151

COURSE TITLE: Calculus with Analytic Geometry II **Units:** 4

Letter Grade or Credit/No Credit Option

CATALOG COURSE DESCRIPTION:

This a continuation of Mathematics 150. This course covers more advanced topics in analytic geometry, differentiation and integration of algebraic and transcendental functions, infinite series, Taylor series, and parametric equations. This course also covers a general introduction to the theory and applications of power series, techniques of integration, and functions in polar coordinates, as it serves as a basis for multivariable calculus and differential equations, as well as most upper division courses in mathematics and engineering. It is intended for the transfer student planning to major in mathematics, computer science, physics, chemistry, engineering and economics.

REQUISITES:

Prerequisite:
MATH 150 with a grade of "C" or better, or equivalent

FIELD TRIP REQUIREMENTS: May be required

TRANSFER APPLICABILITY: Associate Degree Credit & transfer to CSU and/or private colleges and universities CSU General Education IGETC UC Transfer Course List MATH 122 and 151 combined: maximum credit, one course.

CAN DATA: CAN MATH 20 = MATH 151 (City, Mesa, Miramar) CAN MATH SEQ B = MATH 150 + MATH 151 (City, Mesa, Miramar) CAN MATH SEQ C = MATH 252 + MATH 150 + MATH 151 (City, Mesa, Miramar)

TOTAL LECTURE HOURS: 64 - 72

TOTAL LAB HOURS:

STUDENT LEARNING OBJECTIVES:
Upon successful completion of the course the student will be able to:

1. Solve first-order separable differential equations and initial value problems.
2. Solve application problems involving first-order separable differential equations, such as exponential growth and decay.
3. Solve integral problems by first examining the integral, then selecting and applying the appropriate technique of integration.
4. Apply integration to physics problems relating to mass, centers of mass, work, and fluid force.
5. Identify, analyze, and evaluate improper integrals.
6. Evaluate the limits of functions which have the indeterminate forms "zero/zero" and "infinity/infinity" using L'Hôpital's Rule.

7. Transform the other indeterminate forms into those which L'Hôpital's Rule can be implemented.
8. Define an infinite sequence; analyze and assess the monotonicity and convergence of a given sequence.
9. Identify some basic series, including the geometric series, harmonic series, and a telescoping sum.
10. Compare the different convergence tests, including the Integral Test, the Ratio Test, the Root Test, the Comparison Test, the Limit Comparison Test, the Alternating Series Test, and the Divergence Test.
11. Assess the convergence of a series by formulating the comparison of the given series to a known series.
12. Assess if an alternating series converges absolutely, converges conditionally, or diverges.
13. Analyze a series, assess which convergence tests can be applied in determining its behavior, and apply this test to show the series convergence or divergence.
14. Derive the Taylor series of a given function using a variety of techniques.
15. Calculate the radius of convergence of a given power series.
16. Apply Taylor's Theorem and Taylor polynomials to approximate to a certain degree of accuracy, the values of functions at non-trivial points
17. Apply the known power series expansions of important functions to generate the series expansion of other functions.
18. Express a given second degree equation in the form of its standard conic equation and sketch the standard conic sections.
19. Analyze a conic section by rotating it to a standard position.
20. Sketch the graphs of functions in polar coordinates, including cardiods, lemniscates, and limaçons
21. Calculate the areas of a polar regions.
22. Calculate the arclength of polar curves, and the surface area bounded by polar curves.
23. Calculate the equation of tangent lines to polar curves.
24. Express a curve with parametric equations.
25. Calculate the tangent lines and arclengths of parametrized curves.

SECTION II

1. COURSE OUTLINE AND SCOPE:

A. **Outline Of Topics:**
The following topics are included in the framework of the course but are not intended as limits on content. The order of presentation and relative emphasis will vary with each instructor.

I. First-Order Separable Differential Equations
   A. Separation of variables in an equation of the form: $dy/dx = g(x)\,h(x)$
   B. Initial Value Problems
   C. Application problems involving exponential growth and decay

II. Techniques of Integration
   A. Integration by Parts
   B. Trigonometric integrals
   C. Trigonometric Substitution
   D. Partial Fractions
   E. Miscellaneous Substitutions

III. Application of Integration in Physics
   A. Mass
   B. Centers of Mass
   C. Work
   D. Fluid Force

IV. Improper Integrals
   A. Discontinuous functions at a specific point
   B. Unbounded intervals

V. L'Hôpital's Rule
   A. Indeterminate form of
   B. Indeterminate form of
   C. Other indeterminate forms:
      1. zero-time-infinity
      2. 0^0

3. infinity to zero
4. 1^infinity
5. infinity-infinity

VI. Sequences and Series
- A. Infinite Sequences
- B. Monotone Sequences
- C. Series as a sequence of partial sums
- D. Geometric Series
- E. Harmonic Series
- F. Telescoping Sums
- G. Convergence tests for sequences with non-negative terms
  1. Integral Test
  2. Ratio Test
  3. Root Test
  4. Comparison Test
  5. Limit Comparison Test
- H. Alternating Series Test
- I. Absolute Convergence and Conditional Convergence

VII. Taylor Series
- A. Power series expansions
- B. Radius of Convergence
- C. Taylor Polynomials and Taylor Series
- D. Maclaurin series for standard functions
- E. Derivatives and integrals of power series and their radii of convergence

VIII. Conic Sections
- A. Second degree equations
- B. Parabola
- C. Ellipses
- D. Hyperbola
- E. Rotation of Axes

IX. Polar Coordinates
- A. Graphs of functions having the form r = f (thea)
  1. Cardiods
  2. Lemniscates
  3. Limaçons
- B. Areas of polar regions
- C. Arclength to polar graphs
- D. Tangent lines to polar graphs

X. Parametric Equations
- A. Parametrization of curves
- B. Tangent lines to parametrized curves
- C. Arclength of parametrized curves

B. **Reading Assignments:**
Reading assignments are required and may include but, are not limited to, the following:

I. 1. Assigned sections in Calculus, by Larson and Hostetler, 6th edition 1998.
II. 2. Related sections in Calculus, by Anton, 5th edition 1995.
III. 3. Related sections in Calculus by Stewart, 3rd edition 1999.
IV. 4. Related chapters in Calculus, by Hughes¿Hallet, Gleason, Mc Callum, et al 1998.
V. 5. Schaum¿s Outline, Theory and Problems of Calculus, 4th edition 1999
VI. 6. Other calculus text books, periodicals or journals such as Math Horizons, The College Mathematics journal or Mathematics Magazine.
VII. 7. Calculus related topics found on the Internet.

C. **Appropriate Assignments that Demonstrate Critical Thinking:**
Critical thinking assignments are required and may include, but are not limited to, the following:

I. 1. Interpreting and analyzing mathematical principles, symbolic formulas, and problem solving techniques.

II. 2. Analyzing and solving problems that are broader in scope than those present in class, or those introduced in the text.
III. 3. Applying various mathematical concepts in interpreting applications and in solving applied problems.
IV. 4. Investigating a greater variety of problems including applications of principles in a number of different contexts.
V. 5. Reviewing current periodicals.
VI. 6. Developing proofs for mathematical statement.

D. **Appropriate Outside Assignments:**
Outside assignments may include, but are not limited to, the following:

I. Students are expected to spend a minimum of two hours outside of class time in practice and preparation for each hour of lecture. This time is intended to be spent in appropriate reading and written assignments, problem solving, and the understanding of the applications and the theory of single variable calculus. Demonstrations and use of spreadsheet programs such as Microsoft Excel and Computer Algebraic Systems (CAS) packages such as Maple, Derive, MathCad, MPP, or Mathematica are strongly encouraged.
A. 1. Reading and writing assignments as specified in the course syllabus,
B. 2. Reading and reviewing lecture notes,
C. 3. Library, electronic and other archival research,
D. 4. Viewing of assigned/recommended media materials,
E. 5. Observations, e.g. field trips to attend pertinent lectures/conferences,
F. 6. An analytical semester project,
G. 7. Developing problem solving techniques and analytical skills by solving problems from various texts, such as the Calculus Problem Solver,
H. 8. Reviewing current periodicals such as Mathematics Magazine, or Math Horizons,
I. 9. Preparing collaborative projects focusing on expanding mathematical concepts presented in class.

E. **Writing Assignments:**
Writing assignments are required and may include, but are not limited to, the following:

I. Writing assignments are required, and the written work will involve application of critical thinking and analytical skills. A substantial portion of this course is dedicated to reading and applying mathematical concepts. Students should be able to understand and apply principles of calculus to problems in the natural and physical sciences. The students will be required to formulate logical arguments as part of the written homework assignments.
A. 1. Written solutions to problems using proper mathematical terminology involving but not limited to
B. i. Calculating derivatives of inverse trigonometric, hyperbolic and inverse hyperbolic
C. functions,
D. ii. Calculating definite and indefinite integrals using techniques of integration,
E. iii. Calculating improper integrals and using L¿Hôpitals Rule to calculate limits with
F. indeterminate forms,
G. iv. Assessing convergence of sequences and series,
H. v. Calculating power series expansions and the radii of convergence of the power series,
I. vi. Graphing the different conic sections,
J. vii. Parametrizing curves and calculating areas of polar regions, arclength to polar curves,
K. 2. Journal writing with a focus on mathematical calculations, problem solving techniques, and applied problems.
L. 3. Essay homework or test questions may include but are not limited to describing in complete sentences and using proper mathematical terminology proofs of mathematical statements, procedures for performing complicated computations, or the solutions to applied problems.
M. 4. Writing a formal report analyzing some topic or person appropriate to mathematics.
N. 5. Developing proofs for mathematical statements related to the material covered in class.

2. METHODS OF EVALUATION:

A student's grade will be based on multiple measures of performance unless the course requires no grade. Multiple measures may include, but are not limited to, the following:

I. In-class objective quizzes, examinations and a comprehensive final examinations that test for definitions, major mathematical concepts such as techniques of integration, convergence and divergence of a series, power series expansions, or parametric equations; analytical thinking, and problem solving techniques. Exams can consist of free response items, multiple choice items, or a combination.
Out-of-class writing assignments that develop critical thinking and problem solving techniques as it pertains to the application of calculus concepts and theories such as:
A. a. Take home essay examinations.
B. b. Analytical semester projects.
C. c. Written reports on related subjects.
D. d. Exploratory activities involving a graphing calculator or computer Class participation, including:
E. a. Participation in classroom discussion.
F. b. Participation in collaborative assignments.
G. c. Oral presentations on a variety of calculus subjects.
H. d. Group projects.
I. e. Field trips.
J. f. Classroom experiments and simulations. Supplementary activities, including:
K. a. Library and on-line Internet research
L. b. Reviewing current periodicals

3. METHODS OF INSTRUCTION:

Methods of instruction may include, but are not limited to, the following:

* Distance Education
* Lecture
* Other (Specify)
* Distance Education
* 1. Lecture and demonstrations using visual aids including but not limited to the computer, the graphing calculator, or videos;
* 2. Calculator and/or computer assignments;
* 3. Group discussions and problem solving performed in class;
* 4. Quiz and examination review performed in class;
* 5. Optional materials available at the Independent Learning Center;
* 6. Homework and extended projects;
* 7. Field observation and field trip;
* 8. Guest speakers;
* 9. Collaborative projects;
* 10. Technically mediated instruction:
* a. TV
* b. Internet
* c. Point to point
* When this course is offered in a distance learning modality, no additional or special requirements in the areas of Course Content and Scope, Methods of Evaluation, and Required Texts will be necessitated except as specified in each of these sections of the course outline. Each student will receive suitable means for instructor contact, and equal access to all required course materials. All methods of instruction, when used in conjunction with distance learning modality, will be implemented in an equivalent manner as in a traditional classroom setting.

4. REQUIRED TEXTS AND SUPPLIES:
Textbooks may include, but are not limited to:

TEXTBOOKS:
1. Anton. Calculus with Analytic Geometry, 6th ed. Wiley and Sons, Inc, 1998,

2. Edward & Penny. Calculus with Analytic Geometry, 5th ed. Prentice Hall, 1998,
3. Hughes, Hallet, Gleason, McCallum, et al. Calculus, 2nd ed. Wiley and Sons, Inc., 1998,
4. Larson, Hostetler, Edwards. Calculus, 6th ed. Houghton Mifflin Company, 1998,
5. Simmons. Calculus with Analytic Geometry, 2nd ed. McGraw Hill, 1996,
6. Stewart. Calculus, 3rd ed. Brookes/Cole, 1999,
7. Thomas & Finney. Calculus, 9TH ed. Addison Wesley, 1996,
8. Current periodicals, such as: Mathematics Magazine and Math Horizons,

MANUALS:

PERIODICALS:

SOFTWARE:

SUPPLIES:
1. Materials typically used in the course may include, but are not limited to the following: 1. graphing calculator, 2. graph paper, 3. diskettes, 4. journal.

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