Mercer County Community College **Liberal Arts Division**

COURSE OUTLINE

MAT149	Calculus for Social Sciences or Business	4
Course Number	Course Title	Credits

4/Week	0/Week	0/Week	0/Week	15 Weeks
Class or Lecture	Laboratory Work Hours	Laboratory, Shop Studio or Clinic	Work Experience	Semester Length

Not Applicable	Not Applicable
Performance on an Examination/Demonstration	Telecourse

Required Materials:

Text: Calculus for Business, 8th edition
Author: Hoffman
Publisher: McGraw Hill

Scientific Calculator Required

Catalog Description:

Course designed for students of business or social sciences. Topics include the fundamental techniques in differentiation and integration of algebraic, exponential and logarithmic functions, elementary differential equations, maxima-minima, functions of several variables, La Grange Multipliers, and Double Integration.

Latest Review: Spring 2006

Prerequisites: MAT146 with a minimum C grade or appropriate College Level Math placement test score

Co-requisites: None

Course Coordinator: Leslie S. Grunes

Behavioral Objectives:

UNIT I Review **Functions and Graphs**

1. The student will know the definition of function, domain of function, and range of function.
2. The student will know how to calculate values of a function and find the domain of a function.
   Typical examples are:
   Computer g(2), g(0), g(-1) when $g(x) = \frac{x}{(x+1)}$
   Find the domain of $g(x) = \frac{1}{2x-4}$
3. The student will know the definition of composite functions and will be able to find the composition of two functions
   A typical example will be:
   find g(h(x) and specify its domain when
   $g(v) = v^2 + v - 2$, $h(x) = x + 1$
4. The student will know the definition of inverse function and will be able to calculate inverse of a function.
5. The student will construct the function of a word problem from business or social science and will be able to solve the problem.
6. The student will know the definition of the graph of a function and will be able to graph the function Y = f(x) by plotting points.
7. The student will be able to translate from the (x,y) coordinate system to a (x',y') coordinate system.
8. The student will know the definition of symmetry with respect to x-axis, y-axis, and origin and will be able to graph a function by using symmetry.
9. The student will know the definition of linear function and know that the graph is a straight line.
10. The student will know the definition of slope, x intercept, and y intercept.
11. The student will be able to calculate slope given two points or the linear function.
12. The student will know how to find the equation of a straight line given two points, or point-slope, or any variation of the previous two conditions and will be able to graph the straight line.
13. The student will construct the linear function from a word problem in business or social science and will be able to answer any of the questions.
14. The student will be able to explain intuitively continuous functions and will be able to locate points of discontinuity of such as
    $y = \frac{1}{x^2 - 5x + 6}$
15. The student will be able to explain intuitively the limit concept and will be able to calculate limits such as
    $\lim_{x \to 2} \frac{x^2 - 4}{x - 2}$

16. The student will be able to calculate limits as x approaches infinity.
17. The student will be able to define a polynomial function and graph polynomials.
18. The student will be able to calculate x-intercepts of a polynomial.
19. The student will define a rational function and will be able to graph rational functions.
20. The student will find the intercepts of two functions and will be able to find a solve word problem from business and social science.

UNIT II Differentiation

1. The student will know and apply the definition of the derivative.
2. The student will know how to apply the power rule, constant multiple rule, sum rule, product rule, and quotient rule in calculating the derivative.
   Typical examples are:
   a) Power Rule
   $$y = x^8$$
   $$\frac{dy}{dx} = ?$$
   b) Constant Multiple Rule
   $$y = 7x^6$$
   $$\frac{dy}{dx} = ?$$
   c) Sum Rule
   $$y = 8x^8 + 5x^3$$
   $$\frac{dy}{dx} = ?$$
   d) Product Rule
   $$y = \left(x^5 + 4x^3 + 5\right)\left(x^3 + 10x - 7\right)$$
   $$\frac{dy}{dx} = ?$$
   e) Quotient Rule
   $$y = \frac{\left(x^2 + 2x - 21\right)}{x - 3}$$
3. The student will know how to calculate the derivative by using the chain rule.
   Example:
   $$y = \left(x^2 - 2x + 4\right)^5$$
   a)
   $$\frac{dy}{dx} = ?$$

$g(v) = v^3 - 3v^2 + 1$

b) $h(x) = x^2 + 2$

Find $\frac{d[g(h(x))]}{dx}$

4. The student will know how to calculate a derivative of an implicit function.
   Example:

   $x^2x + y^3 + 2y$

   $\frac{dy}{dx} = ?$

5. The student will be able to define an open interval, closed interval, half open interval to the left, and half open interval to the right.
6. The student will be able to define the following:
   a. relative maximum
   b. relative minimum
   c. function increasing on an interval
   d. function decreasing on an interval
7. The student will be able to indicate the geometric significance of the sin of the derivative.
8. The student given a function will be able to determine where it is increasing or decreasing.
9. The student will know how to apply the first derivative to find the relative maximum or relative minimum and will be able to graph the function.
10. The student will be able to define the absolute extrema of a function on an interval and will be able to find this extrema given a function.
11. The student will be able to find an optimal (either a maximum or minimum) of a word problem.
12. The student will be able to define the following:
    a. The second derivative
    b. concave upward
    c. concave downward
13. The student will know the physical interpretation of the second derivative and will be able to use the knowledge given a function.
14. The student will be able to define the second derivative test in order to find a relative minimum or relative maximum and will be able to apply this test given a function.
15. The student will be able to define average rate of change of y with respect to x, instantaneous rate of change of y with respect to x and will be able to apply these definitions given a function.
16. The student will be able to define the percentage rate of change and will be able to find it given a function.

UNIT III Exponential and Logarithmic Functions

1. The student will be able to define the constant e.
2. The student will know how to apply the compound interest formula

$$B(t) = P\left(1+\frac{r}{k}\right)^{kt}$$

3. The student will know how to apply the present value of future money compounded continuously
$$P(t) = B(e)^{-rt}$$
4. The student will know how to find the derivative of exponential and logarithmic functions.
5. The normal probability distribution with its characteristics will be discussed in class.

UNIT IV Integration

1. The student will be able to define an antiderivative.
2. The student will be able to determine if a function F is an antiderivative of a function f.
3. The student will be able to solve a differential equation by separation of variables. The student will apply this technique in solving learning curves, and exponential growth an decay.
4. The student will be able to calculate an integral by using the following formulas.

a) $\int x^n dx = \frac{x^{n+1}}{n+1} + c, \quad n = -1$

b) $\int \frac{dx}{x} = \ln|u| + C$

c) $\int e^x dx = e^x + c$

d) $\int kf(x)dx = k\int f(x)dx$

e) $\int (f(x)+g(x))dx = \int f(x)dx + \int g(x)dx$

5. The student will be able to integrate by substituting a variable u for a function of x. Typical example is:

$$\int \left(x^3+4x+6\right)^5 \left(3x^2+4\right)dx$$

$$\text{Let } u = x^3+4x-6$$

$$n = 5$$

$$du = \left(3x^2+4\right)dx$$

6. The student will be able to integrate by using the method of integration by parts.
7. The student will be able to look up an integral in the tables for a function which he can't integrate by the above methods.
8. The student will be able to define a definite integral.
9. The student will be able to evaluate a definite integral.
10. The student will be able to calculate the area between a function and the x axis for a pre-defined set of limits.
11. The student will be able to calculate the area between two curves.
12. The student will know how to solve a differential equation by separation of variables.

13. The student will be able to do exponential growth and decay model or a learning model using differential equations.
14. The student will know the physical interpretation of the definite integral as the limit of the sum of areas of rectangles between two endpoints of a given function.
15. The student will apply the summation notation for any given exercise.
16. The student will be able to define the average value of a function over an interval.
17. The student will know and apply the formula of the average value of a continuous function f(t) over an interval t [a,b].
18. The student will be able to define the present value of a business venture.
19. The student will be able to calculate a present value problem.

UNIT V Functions of Several Variables

1. The student will be able to find the domain for a function of several variables given.

   Example: $f(r,s,t)=\dfrac{3r^2+5s}{r-1}$ Find the domain

2. The student will be able to compute the value of a function of several variables given the values of each of the independent variables.

   Example: $f(r,s,t)=\dfrac{\left(3r^2+5s\right)}{r-t}=\dfrac{\left(3r^2+5s\right)}{r-t}$ Compute $f(2,3,-1)$

3. The student will be able to find a composite function and finds its domain.
   Example: Given g(x) = x + 2, L(r,s) = 1 + r + 2s
   Find (r,s) = g(h(r,s)) and specify its domain.
4. The student will be able to define the partial derivative of a function of several variables with respect to a given variable.
5. The student will be able to compute the partial derivative with respect to a given variable of any function.
6. The student will calculate the derivative with respect to a variable t using the chain rule where every independent variable is a function of t.
7. The student should be able to define the level curve of a function.
8. The student should be able to find the equation of the level curve given a function of two variables and a specific point.
9. The student should be able to find the formula of a slope level curve.
10. Define for a function of two variables:
    a) relative maximum
    b) relative minimum
    c) critical points
11. The student should be able to find an extremum by using the second derivative test.
12. The student should be able to find an extremum by using the Method of Lagrange Multipliers.
13. The student should be able to find a global extrema (maximum or minimum) or a constrained extrema by applying partial derivatives.
14. The student should be able to evaluate a double integral over rectangular region.
15. The student should be able to solve probability problems by using single and double integrations.

Evaluation:

Examination after each unit and a final examination.