

# COUNTY COLLEGE OF MORRIS

## Course Information Outline

Course Title Advanced Statistics PREFIX&NUMBER MAT 126

Lecture Hours 45 Laboratory Hours 0 Credit Hours 3 Course Fee None

Department Chairperson Approval J. Monaghan  Date 04-03-2009

Division Dean Approval P. Enright  Date 5/1/09

**1. Catalog Course Description**

A continuation of MAT 124 (Statistics). Techniques for collection and analysis of data, emphasizing estimation and hypothesis testing, analysis of variance and regression analysis are included.

**2. Prerequisite(s)**

MAT 124 (grade of "C" or better).

**3. Co-requisite(s)**

None

**4. Textbooks**

Weiss, *Introductory Statistics*, 8<sup>th</sup> ed. (Addison-Wesley)

**5. Supplementary Books and/or Materials**

*Student's Solutions Manual* to accompany Weiss's *Introductory Statistics*, 8<sup>th</sup> ed.

**6. Specialized equipment, supplies, facilities, for classes limited by enrollment or restricted by accreditation and/or equipment limitations. (Information will be used to determine differential funding category.)**

None

**7. Course Content (List of Topics)**

- Review of the normal and sampling distributions
- Confidence intervals for one population mean when  $\sigma$  is known and unknown
- Hypothesis tests for one population mean when  $\sigma$  is known;  $p$ -values
- Hypothesis tests for one population mean when  $\sigma$  is unknown; Student's  $t$ -distribution
- Sampling distribution for the difference between two sample means for independent samples
- Inferences for two population means using independent samples (standard deviations assumed equal, assumed not equal)
- Inferences for two population means, using paired samples
- Inferences for one population standard deviation
- Inferences for two population standard deviations, using independent samples
- Confidence intervals for one population proportion

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- Hypothesis tests for one population proportion
- Inferences for two population proportions, using independent samples
- Chi-square distribution; goodness-of-fit
- Contingency tables, association
- Descriptive methods in regression and correlation
- Regression model, analysis of residues
- Inferences for the slope of the population regression line
- Estimation and prediction; inferences in correlation
- *F*-distribution and analysis of variance

**8. Statement of Course LEARNING OUTCOMES**

- **Create** a confidence interval when the standard deviation is known or unknown
- **Perform** hypothesis tests with one or two population means and one or two population proportions
- **Create and interpret** a chi-square distribution
- **Create and analyze** a regression model
- **Perform** an analysis of variance and interpret the results

**9. Statement of Relation to Curriculum(s)**

MAT 126 is an optional mathematics course in any program.

# COUNTY COLLEGE OF MORRIS

## Course Information Outline

Course Title Probability and Statistics PREFIX&NUMBER MAT 130

Lecture Hours 60 Laboratory Hours 0 Credit Hours 4 Course Fee None

Department Chairperson Approval J. Monaghan *Monaghan* Date 04-03-2009

Division Dean Approval P. Enright *[Signature]* Date 5-1-09

**1. Catalog Course Description**

The fundamental principles of statistical methods integrated with statistical technology. Topics include descriptive statistics, correlation, regression, probability, binomial and normal distributions, sampling, elementary hypothesis testing and confidence intervals. A project is required.

**2. Prerequisite(s)**

MAT 016 or MAT 060 or equivalent.

**3. Co-requisite(s)**

None

**4. Textbooks**

Weiss, Neil, *Introductory Statistics*, 8<sup>th</sup> ed. (Pearson Addison-Wesley)

**5. Supplementary Books and/or Materials**

None

**6. Specialized equipment, supplies, facilities, for classes limited by enrollment or restricted by accreditation and/or equipment limitations.** (Information will be used to determine differential funding category.)

None

**7. Course Content (List of Topics)**

- Overview; types of data, sampling techniques
- Frequency distributions, graphs, charts, dot plots, stem-and-leaf plots, distribution shapes, misleading graphs
- Measures of central tendency, measures of variation
- Percentiles, quartiles, outliers, five-number summary, box plots, standard scores, descriptive measures of a population
- Descriptive methods in correlation and regression, coefficient of determination
- Fundamentals of probability, addition rule, complementation rule
- Contingency tables, joint and marginal probabilities, conditional probability, multiplication rule, independence

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- Counting techniques
- Discrete random variables, probability distributions, binomial distributions
- Normal distribution, assessing normality, normal approximation to the binomial
- Sampling distribution of the mean, central limit theorem
- Confidence intervals for the population mean standard deviation known and unknown, margin of error
- Hypothesis test for population, standard deviation known and unknown,  $p$ -values

**8. Statement of Course LEARNING OUTCOMES**

- **Distinguish** between different methods of random sampling used for data collection
- **Compute** measures of descriptive statistics
- **Construct** confidence intervals for the mean and interpret the results
- **Conduct** hypothesis tests for the mean and **interpret** the results
- **Construct** least-squares linear regression equations
- **Compute** binomial probabilities
- **Compute** Poisson probabilities

**9. Statement of Relation to Curriculum(s)**

MAT 130 is an optional course in Liberal Arts, Business Administration and other programs.

# COUNTY COLLEGE OF MORRIS

## Course Information Outline

Course Title Analytic Geometry and Calculus I PREFIX&NUMBER MAT 131

Lecture Hours 60 Laboratory Hours 0 Credit Hours 4 Course Fee None

Department Chairperson Approval J. Monaghan  Date 04-03-2009

Division Dean Approval P. Enright  Date 5-1-09

**1. Catalog Course Description**

The first semester of a three-semester sequence. Analytic geometry in the plane, differentiation and applications, and integration are covered.

**2. Prerequisite(s)**

MAT 123 (grade of "C" or better) or equivalent.

**3. Co-requisite(s)**

None

**4. Textbooks**

Larson, Hostetler, Edwards, *Calculus of a single Variable*, 8<sup>th</sup> ed. (Houghton Mifflin, 2002).

**5. Supplementary Books and/or Materials**

Edwards, *Student's Study and Solution Guide*, Vol. 1.

**6. Specialized equipment, supplies, facilities, for classes limited by enrollment or restricted by accreditation and/or equipment limitations. (Information will be used to determine differential funding category.)**

None

**7. Course Content (List of Topics)**

- Graphs, models, linear models, rates of change
- Functions and their graphs, preview of calculus
- Finding limits, evaluating limits analytically
- Continuity, one-sided limits, infinite limits, limits at infinity
- The derivative, the tangent line problem
- Differentiation rules, rates of change
- Product and quotient rules, higher derivatives
- Chain Rule, implicit differentiation, related rates
- L'Hôpital's Rule
- Extrema, Rolle's Theorem, Mean Value Theorem
- Increasing and decreasing functions
- Concavity, second derivative test

- Curve sketching, optimization, Newton's Method
- Differentials
- Indefinite integrals, areas
- Riemann sums, definite integrals, fundamental theorem
- Integrations by substitutions; average and r.m.s. values
- Trapezoidal and Simpson's Rules
- Natural logarithms, differentiation, integration; logarithmic differentiation
- Inverse functions; exponential functions, derivatives, integrals
- Bases other than  $e$ , applications, growth and decay
- Inverse trigonometric functions, differentiation

**8. Statement of Course LEARNING OUTCOMES**

- **Understand** the concept of limits and **evaluate** limits of functions given their equations or their graphs
- **Differentiate** functions involving algebraic and various transcendental functions
- **Solve** basic applications of derivative problems such as distance, velocity, and acceleration, and tangent line problems and Newton's Method problems
- **Solve** optimization problems involving various areas of study such as business, engineering, biology, chemistry, and physics
- **Sketch** polynomial and rational functions using techniques of differentiation
- **Use** various techniques of integration to evaluate indefinite integrals, and **find** areas under curves by evaluating definite integrals

**9. Statement of Relation to Curriculum(s)**

MAT 131 is a required course in the mathematics, chemistry, engineering science, scientific programming and math-science programs, and an elective in the biology and business administration programs.

# COUNTY COLLEGE OF MORRIS

## Course Information Outline

Course Title Analytic Geometry and Calculus II PREFIX&NUMBER MAT 132

Lecture Hours 60 Laboratory Hours 0 Credit Hours 4 Course Fee None

Department Chairperson Approval J. Monaghan J. Monaghan Date 04-03-2009

Division Dean Approval P. Enright P. Enright Date 5-1-09

### 1. Catalog Course Description

A continuation of Analytic Geometry and Calculus I, which covers the calculus of inverse trigonometric functions, methods of integration, analytic geometry in the plane including polar coordinates and conic sections, hyperbolic and inverse hyperbolic functions, sequences and series, and parametric equations.

### 2. Prerequisite(s)

MAT 131 or equivalent (grade of "C" or better).

### 3. Co-requisite(s)

None

### 4. Textbooks

Larson, Hostetler, Edwards, *Calculus of a Single Variable*, 8<sup>th</sup> ed. (Houghton Mifflin, 2002).

### 5. Supplementary Books and/or Materials

Edwards, Student's Study and Solutions Guide, Vol. 1

### 6. Specialized equipment, supplies, facilities, for classes limited by enrollment or restricted by accreditation and/or equipment limitations. (Information will be used to determine differential funding category.)

None

### 7. Course Content (List of Topics)

- Brief review of the end of MAT131
- Inverse trigonometric functions; differentiation, integration
- Hyperbolic functions
- Areas between curves; volumes by discs and shells
- Arc length, surfaces of revolution, work and other applications of integration
- Integration rules; integration by parts
- Trigonometric integrals; trigonometric substitutions, partial fractions
- Use of tables, other techniques including  $u = \tan(x/2)$
- L'Hôpital's Rule (done in MAT131), improper integrals
- Sequences, series, tests for convergence

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- Alternating series, ratio and root tests
- Taylor polynomials and approximations
- Power, Taylor and Maclaurin series; Fourier series
- Conic sections, the discriminant, rotation in the plane
- Plane curves, parametric equations
- Polar curves and graphs, area and length in polar equations
- Polar equations

**8. Statement of Course LEARNING OUTCOMES**

- **Choose** and **apply** appropriate integration techniques
- **Model** and **solve** problems including areas, volumes, arc lengths, surface areas, and work
- **Determine** whether a series converges or diverges by selecting an appropriate convergence test and applying it
- **Use** power series to represent functions and **create** Maclaurin and Taylor series for familiar transcendental functions
- **Identify** and **graph** conic sections, including rotation of axes
- **Sketch** graphs of parametric and polar equations, and **apply** derivatives and integrals in parametric and polar forms to solve problems including arc length and surface area

**9. Statement of Relation to Curriculum(s)**

MAT 132 is a required course in the engineering science, mathematics and math-science programs and is an elective in the biology and business administration programs.



# COUNTY COLLEGE OF MORRIS

## Course Information Outline

Course Title Statistics - Honors PREFIX&NUMBER MAT 180  
Lecture Hours 45 Laboratory Hours 0 Credit Hours 3 Course Fee None  
Department Chairperson Approval J. Monaghan *J. Monaghan* Date 04-03-2009  
Division Dean Approval P. Enright *P. Enright* Date 5-1-09

**1. Catalog Course Description**

An introduction to the principles of statistical methods. The course will integrate spreadsheet software to cover such topics as descriptive statistics, correlation, regression, probability, binomial and normal distributions, sampling, elementary hypothesis testing and confidence intervals. Comprehensive case studies will be covered throughout the semester.

**2. Prerequisite(s)**

Permission of honors coordinator or department.

**3. Co-requisite(s)**

None

**4. Textbooks**

Sullivan, Michael III, *Fundamentals of Statistics*, 2<sup>nd</sup> ed. (Pearson Education, 2008).

**5. Supplementary Books and/or Materials**

None

**6. Specialized equipment, supplies, facilities, for classes limited by enrollment or restricted by accreditation and/or equipment limitations.** (Information will be used to determine differential funding category.)

None

**7. Course Content (List of Topics)**

- Introduction; data collection; observational studies, experiments, sampling techniques
- Frequency distributions, statistical graphs, stem-and-leaf plots, dot plots, shapes of distributions
- Measures of central tendency and dispersion
- Measures of position, 5-number summary, box plot
- Scatter diagrams, correlation, least-squares regression, coefficient of determination
- Probability rules, addition rule, complements, independence and multiplication rule
- Conditional probability and general multiplication rule
- Counting techniques
- Discrete probability distributions, binomial probability distribution
- Normal probability distribution: properties, applications, assessing normality

- Normal approximation to the binomial probability distribution
- Sampling distributions
- Confidence intervals about a population mean, population standard deviation known and unknown
- Hypothesis tests for a population mean, population standard deviation known and unknown
- Applications using statistical technology

**8. Statement of Course LEARNING OUTCOMES**

- **Summarize** data using tables, graphs and measures of statistics
- **Use** the z-table to compute normal probabilities
- **Construct** confidence intervals and **conduct** hypothesis tests for the mean and interpret the results
- **Calculate** the correlation coefficient and **construct** least-squares linear regression equations
- **Use** basic rules of probability to compute theoretical, empirical and binomial probabilities
- **Use** statistical software to organize data, **compute** measures of descriptive and inferential statistics, and **construct** basic statistical graphs

**9. Statement of Relation to Curriculum(s)**

Honors Statistics is an optional course for students<sup>3</sup> in the Honors program.

# COUNTY COLLEGE OF MORRIS

## Course Information Outline

Course Title Linear Algebra PREFIX&NUMBER MAT 228

Lecture Hours 45 Laboratory Hours 0 Credit Hours 3 Course Fee None

Department Chairperson Approval J. Monaghan  Date 04-03-2009

Division Dean Approval P. Enright  Date 5-1-09

**1. Catalog Course Description**

Selected topics including matrices and determinants, vectors and vector spaces, linear transformations, eigenvalues and eigenvectors, with applications from a variety of disciplines.

**2. Prerequisite(s)**

MAT 132 (grade of "C" or better).

**3. Co-requisite(s)**

None

**4. Textbooks**

Jain and Gunawardena, *Linear Algebra: An Interactive Approach* (Thomson/Brooks Cole, 2004).

**5. Supplementary Books and/or Materials**

None

**6. Specialized equipment, supplies, facilities, for classes limited by enrollment or restricted by accreditation and/or equipment limitations.** (Information will be used to determine differential funding category.)

None

**7. Course Content (List of Topics)**

- Linear systems of equations; elementary operations
- Gauss elimination method; homogeneous systems
- Introduction to matrices; elementary row operations
- Scalar multiplication, addition, multiplication of matrices; transpose; properties
- Vectors; subspaces; linear dependence and independence; basis; review
- Elementary operations and rank; null space; nullity; elementary matrices
- Inverse of a matrix; properties
- Full-rank factorization and LU-decomposition of a matrix
- Determinants; properties, cofactors and the inverse of a matrix; Cramer's Rule; review
- Eigenvalues, eigenvectors; characteristic equation
- Properties of eigenvectors; diagonalization
- Inner products; orthogonality; Gram-Schmidt process

- Diagonalization of symmetric matrices, applications
- Least-squares solution; review
- Vector spaces
- Linear transformations and matrices; properties

**8. Statement of Course LEARNING OUTCOMES**

- **Identify** and **solve** linear systems of equations using Gaussian elimination
- **Define** and **manipulate** matrices and **apply** factorization techniques
- **Define** and **utilize** determinants and **apply** them to solve systems of equations using Cramer's Rule
- **Explain** and **apply** the Least-Squares approximation process
- **Define**, **describe** and **interpret** vector spaces, and **define** and **apply** linear transformations between spaces
- **Define**, **interpret** and **calculate** eigenvalues and eigenvectors

**9. Statement of Relation to Curriculum(s)**

MAT 228 is a specialized elective in the Mathematics Education Specialization program and may be used as a free elective in the Mathematics and the Engineering Science programs.

# COUNTY COLLEGE OF MORRIS

## Course Information Outline

Course Title Calculus III PREFIX&NUMBER MAT 230

Lecture Hours 60 Laboratory Hours 0 Credit Hours 4 Course Fee None

Department Chairperson Approval J. Monaghan  Date 04-03-2009

Division Dean Approval P. Enright  Date 5/1/09

**1. Catalog Course Description**

A continuation of Analytic Geometry and Calculus II, which includes analytic geometry in three dimensions, functions of several variables, partial derivatives, multiple integrals, vectors, and an introduction to vector analysis.

**2. Prerequisite(s)**

MAT 132 (grade of "C" or better).

**3. Co-requisite(s)**

None

**4. Textbooks**

Stewart, *Multivariable Calculus – Concepts and Contexts*, 3<sup>rd</sup> ed. (Brooks Cole, 2005).

**5. Supplementary Books and/or Materials**

None

**6. Specialized equipment, supplies, facilities, for classes limited by enrollment or restricted by accreditation and/or equipment limitations. (Information will be used to determine differential funding category.)**

None

**7. Course Content (List of Topics)**

- Introduction;  $XYZ$  coordinates, spheres
- Vectors; scalar (dot) and vector (cross) products
- Lines and planes in three dimensions
- Functions and surfaces, quadric surfaces
- Cylindrical and spherical coordinates
- Vector functions, space curves
- Derivatives and integrals of vector functions
- Arc length, curvature, torsion (p. 716), rectifying plane
- Motion in space, parametric surfaces
- Functions of several variables, limits, continuity
- Partial derivatives, tangent planes, linear approximations

- Chain Rule, directional derivatives, the gradient
- Maxima and minima, Lagrange multipliers
- Double integrals and applications
- Surface areas
- Triple integrals in Cartesian, cylindrical and spherical coördinates
- Vector fields
- Line integrals, the Fundamental Theorem
- Green's Theorem
- The curl, the divergence and the Laplace operator
- Surface integrals
- Stokes's Theorem, the Divergence Theorem

**8. Statement of Course LEARNING OUTCOMES**

- **Recognize and manipulate** vectors in two and three dimension
- **Calculate** the equations of lines and planes in three dimension
- **Recognize, classify, and illustrate** functions and surfaces in three dimension
- **Distinguish and relate** rectangular, cylindrical, and spherical coordinates
- **Calculate** limits, derivatives, and integrals of functions of several variables
- **Apply** partial differentiation to locate critical points
- **Apply** multiple integration to calculate areas and volumes
- **Define** vector fields and **calculate** line and surface integrals
- **State and interpret** Green's, Stokes's, and the divergence theorems

**9. Statement of Relation to Curriculum(s)**

MAT 230 is sometimes required in the mathematics program and is prerequisite to PHY 232 (Engineering Physics III).

# COUNTY COLLEGE OF MORRIS

## Course Information Outline

Course Title Differential Equations PREFIX&NUMBER MAT 232

Lecture Hours 45 Laboratory Hours 0 Credit Hours 3 Course Fee None

Department Chairperson Approval J. Monaghan  Date 04-03-2009

Division Dean Approval P. Enright  Date 5/1/09

**1. Catalog Course Description**

Ordinary differential equations and methods of solution. Introduction to classical equations and their solutions, with some applications to geometry, physics and engineering.

**2. Prerequisite(s)**

MAT 132 (grade of "C" or better).

**3. Co-requisite(s)**

None

**4. Textbooks**

Ross, *Introduction to Ordinary Differential Equations*, 4<sup>th</sup> ed. (Wiley).

**5. Supplementary Books and/or Materials**

None

**6. Specialized equipment, supplies, facilities, for classes limited by enrollment or restricted by accreditation and/or equipment limitations.** (Information will be used to determine differential funding category.)

None

**7. Course Content (List of Topics)**

- Introduction
- Variable separable and homogeneous equations, exact equations and integrating factors, linear equations, Bernoulli's, Riccati's and Clairaut's equations
- Trajectories, applications, rate problems Linear equations, homogeneous equations with constant coefficients; undetermined coefficients, variation of parameters, the Cauchy-Euler equation
- Applications: undamped, damped and forced behavior, resonance Power series, Frobenius, Legendre's equation, \* Laguerre's equation, \* Chebychev's equation, \* Hermite equation, \* the gamma function, Bessel's functions and Bessel's differential equation
- Operator method, applications, normal form, homogeneous systems
- Graphical and power series methods, Picard, numerical methods (*important for computer solutions*)
- Laplace transforms (*important for engineering majors*)

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**8. Statement of Course LEARNING OUTCOMES**

- Define, recognize, and classify differential equations
- Identify and solve separable, homogeneous, exact, linear, Bernoulli's, Riccati's, and Clairaut's differential equations and use integrating factors
- Apply differential equations to find orthogonal and oblique trajectories, and solve rate, force, motion, and electric circuits problems
- Solve differential equations using power series techniques
- Classify and solve systems of differential equations
- Apply graphical, power series and numerical methods to solve differential equations
- Define and use Laplace transforms to solve differential equations

**9. Statement of Relation to Curriculum(s)**

MAT 232 is sometimes required in the mathematics program.