



**COWLEY COLLEGE
& Area Vocational Technical School**

COURSE PROCEDURE FOR

**DIFFERENTIAL EQUATIONS
MTH 4465 3 Credit Hours**

Student Level:

This course is open to students on the college level in the sophomore year.

Prerequisite:

Minimum grade of C in Math 4455 CALCULUS III

Controlling Purpose:

To equip science and pre-engineering students with a knowledge of advanced methods in solving differential equations and systems of differential equations.

Learner Outcomes:

Students will learn to solve ordinary linear differential equations by various methods, including simple approximation techniques and Laplace transforms, and be introduced to solving systems of these equations using Laplace transforms and matrix techniques. Technology will be used to a modest extent.

Units Outcomes and Criterion Based Evaluation Key for Core Content:

The following defines the minimum core content not including the final examination period. Instructors may add other content as time allows.

Evaluation Key:

- A = All major and minor goals have been achieved and the achievement level is considerably above the minimum required for doing more advanced work in the same field.
- B = All major goals have been achieved, but the student has failed to achieve some of the less important goals. However, the student has progressed to the point where the goals of work at the next level can be easily achieved.
- C = All major goals have been achieved, but many of the minor goals have not been achieved. In this grade range, the minimum level of proficiency represents a person who has achieved the major goals to the minimum amount of preparation necessary for taking more advanced work in the same field, but without any major handicap of inadequacy in his background.
- D = A few of the major goals have been achieved, but the student's achievement is so limited that he is not well prepared to work at a more advanced level in the same field.
- F = Failing, will be computed in GPA and hours attempted.
- N = No instruction or training in this area.

UNIT I: INTRODUCTION TO DIFFERENTIAL EQUATIONS - 8 hours**(Chapters 2.1-2.6 & 4.1-4.4)**

Outcomes: Upon completing this unit the student will be able to solve ordinary linear first-order differential equations.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Become familiar with the terminology and classification of differential equations.
						Verify solutions for differential equations.
						Solve ordinary linear first-order differential equations by separation of variables and by using integrating factors.
						Set up and solve interesting application problems requiring these techniques.

UNIT 2: NUMERICAL METHODS - 8 hours**(Chapter 3)**

Outcomes: Upon completing this unit the student will be able to approximate ordinary linear first-order differential equations.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Investigate direction fields.
						Approximate solutions using Euler's method, the Runge-Kutta method, and two- and three term Taylor approximations.
						Write programs for approximation technique.

UNIT 3: HOMOGENEOUS LINEAR DIFFERENTIAL EQUATION - 8 hours**(Chapter 6.1-6.9 & 7.1-7.5)**

Outcomes: Upon completing this unit the student will be able to solve higher order homogeneous differential equations.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to:
						Test for the existence of a solution.
						Solve homogeneous equations with constant coefficients and various kinds of roots.
						Solve application problems in undamped and damped vibrations requiring these techniques.

UNIT 4: NONHOMOGENEOUS LINEAR DIFF. EQUATIONS - 8 hours**(Ch 8.1-8.4, 9.3-9.4 & 10.1-10.5)**

Outcomes: Upon completing this unit the student will be able to solve ordinary linear differential equations.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to use:
						Solve nonhomogeneous linear differential equations using the method of undetermined coefficients and variation of parameters.
						Solve application problems in mechanical systems, damped forced vibrations, and electrical circuits.

UNIT 5: LINEAR SYSTEMS OF DIFFERENTIAL EQUATIONS - 8 hours**(Chapter 11.1-11.7 & 12.1-4)**

Outcomes: Students will use the fundamental theorem of calculus to find areas between plane curves, explore techniques of integration and approximation of integrals, and make applications to surplus and continuous income streams.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to :
						Solve simple systems of differential equations by algebraic elimination.
						Solve systems of differential equations using Laplace transforms.
						Use matrices to solve systems of differential equations.
						Solve homogeneous and nonhomogeneous systems with distinct, complex, and repeated eigenvalues.

UNIT 6: THE LAPLACE TRANSFORM METHOD - 8 hours**(Chapter 14.1 - 14.8 & 15.1 - 3; 15.9)**

Outcomes: Upon completing this unit the student will be able to solve initial value problems using the Laplace transform method.

A	B	C	D	F	N	Specific Competencies
						Demonstrate the ability to use:
						Become familiar with the notation of transforms and the conditions under which the Laplace transform method can be applied.
						Find Laplace transforms using tables.
						Find inverse Laplace transforms.
						Use shifting theorems to extend the use of tables.
						Solve initial-value problems using derivatives of Laplace transforms.
						Set up and solve interesting application problems requiring these techniques.

Projects Required:

None

Text Book:

Contact the Bookstore for current textbook.

Materials/Equip:

Computers will be available to the student in the Computer Lab. Students should provide their own graphics calculators such as a TI-89 or TI-92 especially.

Attendance Policy:

Students should adhere to the attendance policy outlined by the instructor in the course syllabus.

Grading Policy:

The grading policy will be outlined by the instructor in the course syllabus.

Maximum class size:

Based on classroom occupancy

Course Timeframe:

The U.S. Department of Education, Higher Learning Commission and the Kansas Board of Regents define credit hour and have specific regulations that the college must follow when developing, teaching and assessing the educational aspects of the college. A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work for

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approximately fifteen weeks for one semester hour of credit or an equivalent amount of work over a different amount of time. The number of semester hours of credit allowed for each distance education or blended hybrid courses shall be assigned by the college based on the amount of time needed to achieve the same course outcomes in a purely face-to-face format.

Catalog Description:

MTH4465 - DIFFERENTIAL EQUATIONS (3 hrs)

Techniques for solving ordinary first and second order differential equations, Laplace transforms, Eigen values, and approximation techniques. This course requires that the students furnish their TI-89 or TI-92 graphing calculator. Prerequisite: Minimum grade of C in MTH4455 Calculus III.

Refer to the following policies:

[402.00 Academic Code of Conduct](#)

[263.00 Student Appeal of Course Grades](#)

[403.00 Student Code of Conduct](#)

Disability Services Program:

Cowley College, in recognition of state and federal laws, will accommodate a student with a documented disability. If a student has a disability which may impact work in this class which requires accommodations, contact the Disability Services Coordinator.