



Indiana State University
College of Technology
Department of Applied Engineering and Technology Management

MET 215
Graphic Analysis

3 credit hours

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I. Foundational Studies

This course is part of the foundational studies program and fulfills the mathematics requirement of the category for mathematics or quantitative literacy.

II. Foundational Studies Program Objectives (FS:PO)

The following is a list of the foundational studies program objectives. While it is not necessary to meet every objective in every course, there is an expectation that several of these objectives will be incorporated into each course.

1. Locate, critically read, and evaluate information to solve problems
2. Critically evaluate the ideas of others
3. Apply knowledge and skills within and across the fundamental ways of knowing (natural sciences, social and behavioral sciences, arts and humanities, mathematics and history)
4. Demonstrate an appreciation of human expression through literature and fine and performing arts
5. Demonstrate the skills for effective citizenship and stewardship
6. Demonstrate an understanding of diverse cultures within and across societies
7. Demonstrate the skills to place their current and local experience in a global, cultural, and historical context
8. Demonstrate an understanding of the ethical implications of decisions and actions
9. Apply principles of physical and emotional health to wellness
10. Express themselves effectively, professionally, and persuasively both orally and in writing

III. Skill and Applied Learning Objectives For All Areas (S&ALO)

The following list of learning objectives are required to be imbedded in all courses within the foundational studies program, except as noted with item three.

1. Developing critical thinking skills
2. Developing information literacy skills
3. Including a graded writing component (except for QL)

IV. Foundational Studies Mathematics Area Learning Objectives (FS:MATH)

The following learning objectives are required for courses, such as this one, which fulfill the mathematics area within the category for mathematics or quantitative literacy. It should be noted that only one course from the mathematics or quantitative literacy category is required in the foundational studies program.

1. Solve for multiple unknowns from available information using appropriate methods
2. Represent and solve real-world problems employing appropriate mathematical models
3. Answer questions using advanced mathematical techniques
4. Interpret and explain the results of advanced mathematical analysis

V. Course Purpose:

This course is designed to develop and instill math problem solving skills necessary in order to understand the concepts and principles of technical mathematics, and to be able to use these concepts and principles to solve industrial/technical problems.

VI. Catalog Description:

Graphically and analytically solving technical mathematical problems commonly encountered by engineers and technologists utilizing elements of algebra, geometry, trigonometry, and statistics.

VII. Prerequisites:

Appropriate score on Maple TA test or satisfactory completion of MATH 111 or higher.

The content of this course requires a working knowledge of algebra and geometry. Such working knowledge could be obtained from multiple (more than one) high school math classes such as advanced algebra, trigonometry, pre-calculus, and geometry.

VIII. Course Learning Objectives/Topics:

- Appropriately select and utilize the following to solve word problems¹
 - Algebraic operations and geometry
 - Trigonometric functions

¹ **Math Learning Objective #1:** Students will solve for one or more unknowns from available information using appropriate methods.

- Vectors, determinants, and matrices
- Financial and mixture formulas
- Functions of moments and statics
- Statistical measures
- Simple & Quadratic Formulas
- Solve mathematical word problems relevant to engineers and technologists in the various fields in which they serve²
- Create charts and graphs displaying results of word problems³
- Exhibit a working knowledge of statistics through⁴
 - Calculating measures of central tendency
 - Calculating measures of dispersion
 - Converting to z-scores and transforming scores
 - Interpreting statistics
 - Solve mathematical problems through teamwork

IX. Course Outline

a. Module One – Algebra/Geometry Refresher

i. Algebra

1. Solving for a single variable
2. Associate, distributive, other basic rules
3. Linear equations
4. Financial problems
5. Mixture problems
6. Word problem solving strategies

ii. Geometry

1. Lines, corresponding angles, transversals
2. Ratio problems, slope
3. Areas of regular and irregular shapes
4. Interpreting data

b. Module Two – Elements of Trigonometry

i. Trigonometry for right angles

1. Coordinate plane

² **FS Program Objective #1:** By design of problems students will locate, critically read, and evaluate information. **Skill and Applied Learning Objectives #1 & #2:** Solving technology related mathematical word problems students will develop critical thinking skills while determining what information is needed to solve the problem and which formulas are necessary. Through this investigation students will develop information literacy skills. **Math Learning Objective #2:** Students will represent and solve real-world problems employing appropriate mathematical models some of which are outlined in section VI.

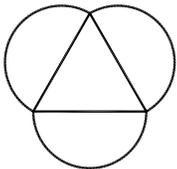
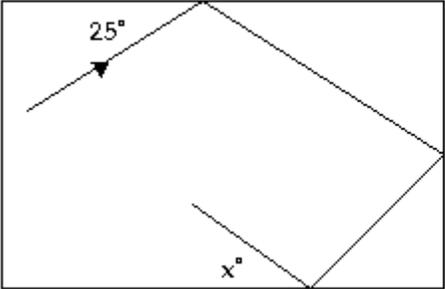
³ **FS Program Objective #1:** By design of problems students will locate, critically read, and evaluate information. **Skill and Applied Learning Objectives #1 & #2:** Solving technology related mathematical word problems students will develop critical thinking skills while determining what information is needed to solve the problem and which formulas are necessary. Through this investigation students will develop information literacy skills. **Math Learning Objective #3:** Students will answer questions using advanced mathematical techniques.

⁴ **FS Program Objective:** By design of problems students will locate, critically read, and evaluate information. **Skill and Applied Learning Objectives #1 & #2:** Solving technology related mathematical word problems students will develop critical thinking skills while determining what information is needed to solve the problem and which formulas are necessary. Through this investigation students will develop information literacy skills. **Math Learning Objective #4:** Students will interpret and explain the results of advanced mathematical analysis.

- 2. Standard position and labeling
 - 3. Interpreting data
 - 4. The six trig functions
 - ii. Applications of right angle trigonometry
 - 1. Gravity
 - 2. Force
 - 3. Statics
 - 4. Linear velocity
- c. Module Three - Graphing applications**
 - i. Vector analysis
 - 1. Resultants
 - 2. Magnitudes
 - 3. Methods of addition
 - ii. Sine waves
 - 1. Amplitude
 - 2. Period
 - 3. Frequency
 - 4. Phase shift
- d. Module Four – Systems of equations**
 - i. Linear equations
 - ii. Determinants
 - iii. Matrices
 - iv. Graphing techniques
- e. Module Five - Statistics**
 - i. Central Tendency
 - 1. Mean
 - 2. Median
 - 3. Mode
 - 4. Standard deviation
 - ii. Normal curve
 - 1. Z-scores
 - 2. Score transformation
 - 3. Data interpretation
 - iii. Probability

The table on the following pages depicts typical questions from the categories that are discussed and solved in the classroom setting. For online students, a program has been developed in Flash format that discusses similar problems and provides a step by step method to solving word problems using a graphing calculator. Students can listen to each step or jump to the steps they do not understand. Learning objectives are stated for each problem.

The foundational studies learning objectives that are specifically addressed in some fashion have been charted. While it is evident some problems address some learning objectives better than others, if a problem addresses the objective at all it was so noted.

Module/ section	Possible question	FS: MATH				SALO		FS: PO			
		1	2	3	4	1	2	1	2	3	5
Module 1 – algebra/geometry refresher											
Algebra	A field of plants that cannot stand fertilizer with more than 14% potash needs 2.3 tons of fertilizer. The only available fertilizer contains 29% potash. How much of this fertilizer must be diluted to make enough of the usable mixture?	X	X	X		X		X	X	X	X
Geometry	Semicircles are placed on the sides of an equilateral triangle with sides 10.7 ft long as shown. Find the total area of the drawing shown below. 	X	X	X		X		X	X		
	A pool ball is hit as shown in the diagram. Find the value of x . 	X	X	X		X		X	X	X	X
Module 2 – Elements of Trigonometry											
Right angle trig	Solve for a right triangle giving the results for all missing angles and lengths by using the information provided below. Each of your final results should be rounded to the appropriate number of significant digits. $B = 52.2^\circ$, $c = 0.315$ cm	X	X	X		X		X	X		
	When sitting atop a tree and looking down at his pal Joey, the angle of depression of Mack's line of sight is 40.5 degrees. If Joey is known to be standing 40 ft from the base of the tree, how tall is the tree? Explain your answer and/or show your work.	X	X	X	X	X		X	X	X	X
Applications of trig	A satellite in a circular orbit 854.0 miles above the earth makes one complete orbit every 85.34 minutes. What is its linear speed? Use 3963 miles for the length of the radius of the earth. Explain your answer and/or show your work.	X	X	X	X	X		X	X	X	X

Module/ section	Possible question	FS: MATH				SALO		FS: PO			
		1	2	3	4	1	2	1	2	3	5
Module 3 – Graphing applications											
Vector analysis	Lookout station B is located 9 miles due east of station A. The bearing of a fire from station A is South, 11 degrees 20 minutes West. The bearing of the same fire from station B is South, 35 degrees 10minutes West. Determine the distance from the fire to station B (to the nearest tenth of a mile). Explain your answer and/or show your work.	X	X	X	X	X		X	X	X	X
Sine Waves	Sketch the graph of the following function over the interval of $0 \leq x \leq 2\pi$ and confirm by analyzing with your scientific calculator. $y = 2 \sin (4x + \pi/4)$	X		X		X	X	X	X		
Module 4 – Systems of equations											
Linear Equations	An airplane travels 500 miles against the wind in 5 hours, and makes the return trip with the same wind in 2 hours. Find the speed of the wind. Round your answer to the appropriate amount of significant digits.	X	X	X		X		X	X	X	X
Matrices	A grain dealer sold to one customer 5 bushels of wheat, 2 of corn, and 3 of rye, for a total of \$26.70; to another, 2 of wheat, 3 of corn, and 5 of rye for a total of \$29.80; and to a third, 3 of wheat, 5 of corn, and 2 of rye, for a total of \$26.10. What was the price per bushel of corn?	X	X	X	X	X		X	X	X	X
Module 5 - Statistics											
	In a certain parking lot, 45% of the cars have four doors, 16% of the cars are blue, and 4% of the cars have four doors and are blue. What is the probability that a car chosen at random will have either four doors or a blue color, but not both?	X	X	X	X	X		X	X	X	X
	The distribution of grades on a certain test has a mean of 85.5 with a standard deviation of 11.2. There are 400 tests. Assuming that the grades are normally distributed, predict the number of students scoring between 75 and 95. Use a table of area under the curve within z standard deviations of the mean.	X	X	X	X	X		X	X	X	X
	The life of a certain type of battery was measured for a sample of batteries with the following results (in number of hours): 34, 33, 26, 30, 28, 35, 25, 27, 36, 33, 30, 26, 31, 35, 29, 27, 29, 33, 30, 35 a. Form a cumulative frequency table for this data using 6 classes. b. Construct a histogram of the data in EXCEL and import to this Word document c. The mode is: _____ d. The Median is: _____ e. The Mean is: _____	X	X	X	X	X	X	X	X	X	X
	A certain grade egg must weigh at least 2 oz. If the weights of eggs are normally distributed with a mean of 1.5 oz and a standard deviation of 0.4 oz, approximately how many eggs in a random sample of 23 dozen would you expect to weigh more than 2 oz?	X	X	X	X	X		X	X	X	X

X. Course Assignments:

a. Homework:

Each student is expected to complete the required reading and subsequent quiz over the material as assigned, in a timely manner. Quizzes will be on Blackboard. Students are expected to log onto Blackboard at <http://blackboard.indstate.edu> and navigate to their appropriate class. The login for Blackboard is the same as your MyPortal login.

The advantage to taking quizzes online is the feedback. You will receive a score immediately and be able to see your mistakes (if any). This method provides more immediate feedback, which should help to prevent you from learning the wrong answer as true.

Follow the schedule of assignments as posted in ASSIGNMENTS under the heading of homework assignments. The assignments will not necessarily consist of problems in the textbook.

Homework will only be available during the time allowed. Once the submission deadline is passed, you will no longer see the link.

The following is a step by step process for completing and submitting the homework.

1. Locate the assignment under assignments/homework.
2. Download the Word file to your computer and print it.
3. Work out the assigned problems using information from the text and at the Blackboard course site in course documents/module/section and the online calculator program located in course documents. All of these resources will help you with the homework assignment in understanding the concepts and problems.
 - a. *Bring the homework to class. Ask questions, verify your understanding, make sure you can do that type of problem*
 - b. *Try asking your lecture partner about how to do problems.*
 - c. *Attend the instructor's extra help sessions. Ask specific questions. Your time is valuable.*
4. Once you have worked out the problems and selected the best answer for each, again log onto the course site and navigate to ASSIGNMENTS
5. Proceed to Homework Quizzes section
6. Locate the corresponding Module/Section
7. Choose the quiz for the completed homework section. This quiz will contain the exact problems you were assigned as homework. The quiz is multiple-choice with four possible answers for each problem.
8. Select the best possible answer based on your calculations.
9. When you are finished answering all questions, click submit.

After results are posted you will be able to view the homework and see the correct answers. If you missed something, take this opportunity to attempt to figure out your mistake. Don't hesitate in e-mailing the instructor if you can't figure out your mistake on your own.

b. Notebook

Each student must maintain a three ringed notebook containing pertinent class materials and that the notebook be organized somewhat in the following manner:

- Cover sheet: Name, Course Name, Semester Taken
- Section 1: Class Syllabus
- Section 2: General Class Notes and Those Taken from Readings
- Section 3: Homework Handouts and troubling/unfinished problems.

For face-to-face students, the complete notebook will be turned in near the conclusion of the course for a "to be determined" amount of credit.

c. Participation

Face-to-face students get the best results (grades) by attending class regularly.

Attendance will be taken each session. Attendance will give you points of extra credit to be added throughout the semester. Normally there will be one point awarded for each session attended.

Students are required to interact with the Blackboard website at least 3 days per week

d. Quizzes for face-to-face sections

It is highly probable that there will be a very short (10 minutes) quiz at the beginning or end of every class period. These quizzes will count toward your final grade. You may not make up these quizzes if you are absent or otherwise not present during the time the quizzes are given.

e. Exams

NINE chapters in the textbook will be covered. There will be five exams covering approximately two chapters each. These exams will consist of two parts with the exception of the last exam. One part will be taken in-class or on-line with time constraints and the other part will be take-home. All tests are open-book. You are not to discuss the take-home portion of the exam with anyone other than myself until after you have submitted the exam.

There will be five exams total. There will be no comprehensive final exam, although you will be required to take an exam on the scheduled “final exam” date. This “final exam” will be one part only. On this last module and exam the student will develop and interpret charts and graphs in excel and transfer those into a Word document to answer questions.

The take-home exam requires that a student signs and dates a statement on the exam stating they received no help on the exam other than from the instructor. The signing of this statement after reading a passage of subsequent consequences demonstrates an understanding of the ethical implications of decisions and actions (FS:PO 8).

XI. Course Evaluation Methods:

The student’s final grade for this course will be based upon the total points accrued in the following areas.

Participation/Quizzes	20%	160 points
Assigned Homework	30%	275 points @ 25 (1-8) 75 (9)
Exams	<u>50%</u>	375 points @ 75 each
	100%	

A	=	92% - 100%
A-	=	90% - 92%
B+	=	88% - 90%
B	=	82% - 88%
B-	=	80% - 82%
C+	=	78% - 80%

C	=	72% - 78%
C-	=	70% - 72%
D+	=	68% - 70%
D	=	62% - 68%
D-	=	60% - 62%
F	=	0% - 60%

XII. Typical Homework Schedule

Dates in *italics* are the **last date** that any work will be accepted for the **Module** without prior consent of the professor.

Week 1 Pretest Chapter 1	2 Chapter 2	3 Chapter 3	4 Module One - Consisting of Chapters 1, 2, & 3 and Exams 1 and 1A
5 Work on Chapter 4	6 Chapter 4 & 8	7 Chapter 8	8 Module 2 - Consisting of chapters 4 & 8 and Exams 2 and 2A
9 Chapter 9	10 Chapters 9 and 10	11 Module 3 - Consisting of Chapters 9 & 10 and Exams 3 and 3A	12 Chapter 5
13 Module 4 - Consisting of Chapter 5 and Exams 4 and 4A	14 Chapter 22	15 Chapter 22	16 Last test Covers only chapter 22 Module 5 - Consisting of Chapter 22 and Exam 5 Completed by 1600

XIII. Course Materials:

Textbook: *Basic Technical Mathematics 10th ed.*
Allyn J. Washington
ISBN: 0-321-13193-2

Software: Access to the Internet is essential

Reference Materials: None

Other Materials: To adequately complete this course you will need to acquire a graphing calculator.

This course will specifically demonstrate the usage of a Texas Instrument 83+ or 89 series graphing calculator.

I cannot stress enough how much this calculator will help you throughout this course.

Please purchase, or have at your disposal, a TI-83+, TI-89, or equivalent calculator. The price, for these, ranges from about \$90 to as much as \$200 depending on the extras.

I have found these readily available at STAPLES or OFFICE MAX.

Other Fees: None

XIV. Ways to Contact Professor:

Email: Office phil.cochrane@indstate.edu. When emailing the course number (i.e. MET 215 must appear in the subject line).

Phone: Office 237-3978

XV. RIGHT OF REVISION:

This course syllabus, pertaining primarily to the schedules and procedures are subject to change at the discretion of the instructor. Ample notification of any and all changes will be given.

XVI. ATTENDANCE:

Students are expected to attend (and participate in) all class sessions. Please refer to the University Policy on attendance as published in the University Standards.

XVII. ACADEMIC HONESTY STATEMENT:

The University is committed to academic integrity in all its practices. The faculty value intellectual integrity and a high standard of academic conduct. Activities that violate academic integrity undermine the quality and diminish the value of educational achievement.

Cheating on papers, tests or other academic works is a violation of University rules. No student shall engage in behavior that, in the judgment of the instructor of the class, may be construed as cheating. This may include, but is not limited to, plagiarism or other forms of academic dishonesty such as the acquisition without permission of tests or other academic materials and/or distribution of these materials and other academic work. This includes students who aid and abet as well as those who attempt such behavior.

XVIII. AMERICANS WITH DISABILITIES ACT:

Indiana State University seeks to provide effective services and accommodation for qualified individuals with documented disabilities. If you need an accommodation because of a documented disability, you are to register with Disability Support Services at the beginning of the semester. Contact the Director of Student Support Services, Gillum Hall, room 202A, 237-2301. The director will ensure that you receive all the additional help that ISU offers. If you will require assistance during an emergency evacuation, notify your instructor immediately. Look for evacuation procedures posted in your classroom.

XIX. LAPTOP USAGE

When this class is taught face-to-face:

Laptop Not Required for Course: Usage Permitted: While there will be no assignments or examinations for which the laptop will be used, your use of a laptop is generally permitted as long as such usage remains within the bounds of the Code of Student Conduct and it conforms to the provisions of its use as laid out in this syllabus. There may be occasions where laptop usage is forbidden and if that occurs, failure to comply with this direction will be viewed as a violation of the Code of Student Conduct.