A. Course Description

- Credits: 4.00
- Lecture Hours/Week: 4.00
- Lab Hours/Week: 0.00
- OJT Hours/Week: 0
- Prerequisites:
  - MATS 0600: Intermediate Algebra
  - MATS 0700: Algebra Emporium
- Corequisites: None
- MnTC Goals:
  - 04 – Mathematical/Logical Reasoning

A course combining elements of college algebra, college trigonometry, and statistics, with a particular focus on topics useful to future engineers or engineering techs. Manipulating literal equations; solving equations analytically and by graphing; identifying, analyzing, and specifying linear, quadratic, polynomial, power, reciprocal, exponential, logarithmic, and sine/cosine functions; solving systems of equations analytically and using matrix solvers; setting up and solving systems of equations for practical applications; trigonometric functions; laws of sines and cosines; vector analysis of forces in static equilibrium; basic concepts of probability; bell curve; confidence intervals and uncertainty analysis; correlation and regression.

B. Course Effective Dates: 1/31/19 – Present

C. Outline of Major Content Areas

As noted on course syllabus

D. Learning Outcomes

1. Review methods for solving linear and quadratic equations.
2. Understand what parameters are needed to specify each of the functions in objective 8.
3. Solve 2x2 linear systems using graphing, substitution, and elimination methods.
4. Solve 3x3 linear systems analytically.
5. Write 3x3 linear systems in matrix form and use Gaussian elimination to solve.
6. Solve n-dimensional systems of linear equations using free/online matrix solvers.
7. Write variables, expressions, and equations to analyze and solve verbal problems such as percent change,
mixture, and curve-fitting problems (multiple variables).
8. 16. Use Kirchhoff's laws to analyze basic DC circuits (systems of equations showcase).
9. 17. Use trigonometric functions and Pythagorean Theorem to solve right triangles.
10. 18. Find all angles between 0-360 degrees that have a given sine, cosine, or tangent, and resolve ambiguous cases.
12. 2. Rearrange formulas and literal equations to solve for any variable explicitly (examples should be taken from civil tech, energy tech, and biomed tech programs).
13. 20. Apply trigonometry to real-world applications such as those related to surveying.
14. 21. Represent forces and velocities with vectors (both rectangular and polar forms).
15. 22. Solve for the resultant of a system of vectors.
16. 23. Use the principle of static equilibrium to analyze forces in a truss or other structure (systems of equations showcase).
17. 24. Represent large data sets using frequency tables and histograms.
18. 25. Calculate measures of center: mean, median, mode, midrange.
20. 27. Convert data to/from z-scores and percentiles, distinguishing "usual" from "unusual" individuals.
21. 28. Apply the Central Limit Theorem to distinguish "usual" from "unusual" collections or groups.
22. 29. Calculate probabilities using the classical definition.
23. 3. Interpret and analyze direct, inverse, and joint variation problems with engineering applications.
24. 30. Analyze dependent and independent events using the multiplication rule.
25. 31. Analyze mutually exclusive events using the addition rule.
26. 32. Model Bernoulli trials using the binomial distribution.
27. 33. Understand the link between the binomial and normal distributions.
28. 34. Model random arrival processes using the Poisson distribution.
29. 35. Determine probabilities experimentally, using Excel.
30. 36. Distinguish zeroth-order, first-order, and nth-order sources of uncertainty for experimental measurements.
31. 37. Given a set of data, construct confidence intervals (error bars) for the mean and standard deviation.
32. 38. Using Excel, calculate the linear correlation coefficient, r, and interpret the result.
33. 39. Perform regression on a set of data, using various models such as those listed in objective 8.
34. 4. Write variables, expressions, and equations to analyze and solve other verbal problems such as percent change and mixture problems (one variable).
35. 5. Solve complex equations graphically, using free/online graphing applications.
36. 6. Model fixed cost/variable cost and similarly structured problems using straight-line equations and graphs.
37. 7. Explore analytic geometry: distance formula, parallel and perpendicular lines, circles, parabolas, and tangents to circles and parabolas.
38. 8. Generate graphs for a "library" of functions, including linear, quadratic, polynomial, reciprocal, power law, exponential, logarithmic, and sine/cosine functions.
39. 9. State examples of physical phenomena that follow each of the forms listed in objective 8.
E. Minnesota Transfer Curriculum Goal Area(s) and Competencies

Goal 04 — Mathematical/Logical Reasoning

1. Illustrate historical and contemporary applications of mathematical/logical systems.
2. Clearly express mathematical/logical ideas in writing.
3. Explain what constitutes a valid mathematical/logical argument (proof).
4. Apply higher-order problem-solving and/or modeling strategies.

F. Learner Outcomes Assessment

As noted on course syllabus

G. Special Information

None noted