MATH 270 – Linear Algebra

1. **Course Description**
   - This course introduces students to the concepts of linear algebra. Topics include matrix algebra, Gaussian elimination, determinants of a matrix, properties of determinants, vector spaces and their properties with an introduction to proofs, linear transformations, orthogonality, eigenvalues and eigenvectors, and computational methods.
2. **Topics Covered**
   - Matrix algebra
     - Matrix algebra
     - Matrix invertibility
     - Matrix transpose
     - Special matrices: diagonal, triangular, and symmetric.
   - Systems of linear equations
     - Techniques for solving systems of linear equations including Gaussian elimination and Gauss-Jordan elimination
     - Relationship between coefficient matrix invertibility and solutions to a system of linear equations and the inverse matrices.
   - Determinants and their properties
     - Cofactor expansion
     - Elementary operations
     - Properties of determinant.
   - Vector spaces
     - Definition
     - Basis and dimension of vector space
     - Linear independence and dependence
     - Coordinatization
     - Vector algebra for Rn
     - Real vector space and subspaces
     - Matrix-generated spaces: row space, column space, null space, rank, nullity.
   - Linear transformation
     - Definition
     - Maps from Rn to Rm
     - Algebra of linear transformation
     - Change of basis
     - Kernel, range, rank
     - Matrices of general linear transformations
     - Inverse linear transformations.
   - Inner products on a real vector space
     - Dot product, norm of a vector, angle between vectors, orthogonality of two vectors in Rn
     - Angle and orthogonality in inner product spaces
     - Orthogonal and orthonormal bases; Gram-Schmidt process.
   - Eigenvalues, eigenvectors, eigenspace

- Characteristic polynomial, trace
- Diagonalization including orthogonal diagonalization of symmetric matrices.

o Numerical methods
- LU decomposition of a matrix
- Gaussian elimination with partial pivoting
- Iterative methods for solving linear systems
- Power method for approximating eigenvalues.

o Introduction to computing environment (such as MATLAB)
- Commands for creating vectors, matrices, solving linear systems
- Commands for matrix addition, scalar multiplication, matrix multiplication, matrix inversion, trace, transpose
- Commands for determinants, eigenvalues, eigenvectors.

o Using graphing technology to analyze topics
- Graphical manner
- Numerical manner
- Tabular manner.

3. **What to expect?**
   - Time: The most common term lengths are listed below; others would be proportionate. Outside of class time is studying, completing homework, reviewing, etc.

Length of term	In-class time	Out-of-class time (typical)	Total hours/wk (typical)	Total Term hours (typical)
17 weeks	4 hrs/wk	8 hrs/wk	12	204
6 weeks	11.3 hrs/wk	22.7 hrs/wk	34	204

   - Technology: Graphing technology is used,
   - Grading: Students who earn a grade of C or higher in Math 270 will pass this course.
4. **Who should enroll**?
   - This course is strongly recommended for students in STEM majors who have completed Math 155 (Calculus II) with a grade of C or better.
5. **What prior knowledge students need to know to be successful?**
   - Vectors
   - Solving systems of linear equations in two and three variables by substitution and elimination methods
   - Equations of lines and planes