SYLLABUS: ENGINEERING MATHEMATICS 2

Date / Revision 15 August 2017 / 15-08-17/ MaS
Faculty Engineering and Lifesciences
Study Programs All Engineering Study Programs

SUBJECT: Engineering Mathematics 2

1 Basic Information

1.01	**Subject Name**	**Engineering Mathematics 2**
1.02	**Semester**	2
1.03	**Level**	2
1.04	**SKS**	3
1.05	**Mandatory / Curriculum**	F-04
1.06	**Subject Code**	MATH
1.07	**Subject Code**	ENG-F-MATH-223
1.08	**Year**	2017 (7)
1.09	**Quality Control**	Final Test, see evaluation
1.10	**Limitations**	Min 12 and Max 32 students in one class
1.11	**Combined with**	All engineering study programs
1.12	**Perquisite**	Engineering Mathematics 1
1.13	**Responsible**	Dean of Engineering- and Lifesciences Faculty
1.14	**Revision**	15-08-2017/MaS

2 Description of Subject

The course is designed to challenge students to further develop and extend their mathematical modeling and critical thinking skills by applying strategies and concepts from linear algebra and multivariable calculus to engineering and science problems.

3 Objectives

- Introduce linear equations.
- to solve the linear equations using multiple methods.
- to learn the matrix, vectors mathematics operation.
- to learn the multivariable function calculus

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- to solve differential equations
- Impart relevant skills and knowledge for independent learning of other subjects that require such skills and knowledge.

4 Competency

After having the course, students are expected to:

- Solve systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion.
- Carry out matrix operations, including inverses and determinants.
- Demonstrate understanding of the concepts of vector space and subspace.
- Demonstrate understanding of linear independence, span, and basis.
- Determine eigenvalues and eigenvectors and solve eigenvalue problems.
- Apply principles of matrix algebra to linear transformations.
- Demonstrate understanding of inner products and associated norms.
- Demonstrate understanding of multivariable functions and calculus.
- Demonstrate understanding of basic vector calculus operations.
- Solve second-order differential equation with constant coefficients.

5 Learning Approach / Methodology

- Lectures/ Class contact (time-tabled) supplemented with interactive questions and answers;
- Circuit simulation using Electronic Workbench Software;
- Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing;
- Student Study Effort: homework/assignment; preparation for test/quizzes/ examination.

6 Evaluation

5.1	**Absence maximum**	25%
5.2	**Participation in Discussion**	05 Points
5.3	**Homework / Classwork**	05 Points
5.4	**Presentation /Simulation**	10 Points
5.5	**Daily Quiz**	20 Points
5.6	**Final Examination**	60 Points
	Total	100 Points

7 Text Book and Reference

1	**Main Text Book:** • "Calculus: Early Transcendental Functions", **Author**: Robert T. Smith Roland Minton, **Publisher**: McGraw Hill – Higher Education; **ISBN**: 0 07353232 0

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2	**Supplement Textbooks:** • "Advanced Engineering Mathematics, 10th_Edition", **Author**: Erwin Kreyzig, **Publisher**: John Wiley, **ISBN**: 978-0-470-45836-5 • "Elementary Linear Algebra," 11th edition, **Author**: Howard Anton and Chris Rorres, **Publisher**: John Wiley & Sons; **ISBN**: 978-1-118-67745-2.

8 Content / Topics of Lecture

Week	Content/ Topics of Lecturing	Text Book	Remark
1-2	**Systems of Linear Equations and Matrices:** • Introduction to Systems of Linear Equations • Gaussian Elimination • Matrices and Matrix Operations • Inverses: Algebraic Properties of Matrices • Diagonal, Triangular, and Symmetric Matrices • Applications of Linear Systems	1: Ch 1	Quiz
3	**Determinants:** • Determinants by Cofactor Expansion • Evaluating Determinants by Row Reduction • Properties of Determinants; Cramer's Rule	1: Ch 2	
4	**Euclidean Vector Spaces:** • Vectors in 2-Space, 3-Space, and n-Space • Norm, Dot Product, and Distance in R^n • Orthogonality • The Geometry of Linear Systems • Cross Product	1: Ch 3 2: Ch 10	Quiz Homework
5-7	**General Vector Spaces:** • Real Vector Spaces • Subspaces • Linear Independence • Coordinates and Basis • Dimension • Change of Basis • Row Space, Column Space, and Null Space • Rank, Nullity, and the Fundamental Matrix Spaces • Matrix Transformations from R^n to R^m • Properties of Matrix Transformations • Geometry of Matrix Operators on R^2 • Dynamical Systems and Markov Chains	1: Ch 4	Quiz
8	**MIDTERM SEMESTER BREAK**		
9-10	**Eigenvalues and Eigenvectors:** • Eigenvalues and Eigenvectors • Diagonalization • Complex Vector Spaces • Differential Equations	1: Ch 5	Quiz Homework

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11	**Inner Product Spaces:** • Inner Products • Angle and Orthogonality in Inner Product Spaces • Gram-Schmidt Process; QR-Decomposition • Best Approximation; Least Squares • Least Squares Fitting to Data • Function Approximation; Fourier Series	1: Ch 6 2: Sec 8.9	Quiz
12-13	**Functions of Several Variables and Partial Differentiation:** • Functions of Several Variables • Partial Derivatives • Tangent Planes • The Gradient and Directional Derivatives • Vector Fields, Curl, and Divergences • Extrema of Functions of Several Variables • Constrained Optimization and Lagrange Multipliers	2: Ch 12 2: Sec 14.5	Quiz Homework
14	**Diagonalization & Quadratic Forms:** • Orthogonal Matrices • Orthogonal Diagonalization • Quadratic Forms • Optimization Using Quadratic Forms • Hermitian, Unitary, and Normal Matrices	1: Ch 7	Quiz
15	**Second-Order Differential Equations:** • Second-Order Differential Equation with Constant Coefficients • Nonhomogeneous Equations: Undetermined Coefficients • Applications of Second-Order Equations	2: Ch 15	
16	**Final Examination**		

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