Course Code: BSC101A

Course Title: Engineering Mathematics-1

Course Leaders:

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Course Details

- Programme: **B. Tech. in Electronic & Communication, Computer Science, Electrical and Electronics, Mechanical and Civil Engineering**
- Department: **Mathematics**
- Faculty: **Science and Humanities**
- Dean: **Prof. M.R. Srinivasan (dean.sh@msruas.ac.in)**

Why this Course - ME

Refer to B. Tech. Mechanical Engineering Course Specifications
The objectives of the course are:

1. To facilitate the understanding of underlying engineering principles of mechanical systems to explain their construction and working
2. To model, simulate and analyze the behavior of mechanical systems to predict and improve their performance
3. To design and fabricate mechanical systems to meet the specific needs
4. To instrument and test of mechanical systems for validation
5. To educate on professional ethics, economics, social sciences and interpersonal skills
6. relevant to professional practice
7. To provide a foundation in mathematical, scientific and Engineering & technology fundamentals to solve Engineering and Technology related problems
8. To provide a general perspective and opportunities for a career in industry, business and
9. Commerce

The subject is being delivered to meet the highlighted objective of the course to meet the course aim

Why this Course– ECE

Refer to B. Tech. Electronics and Communication Engineering Course Specifications

The objectives of the course are:

1. To impart knowledge on electronic and communication systems
2. To enhance the understanding of the underlying principles of electronic and communication systems
3. To develop abilities to design analog and digital system/controllers to meet the required specifications
4. To develop abilities to model, simulate and analyse the characteristics of electronic signals and systems
5. To train on computer programming abilities and skills
6. To train on industry standard simulation tools for simulation and analysis of electronic systems
7. To impart training on instrumentation, test and measurement
8. To build and test electronic systems
9. To provide a foundation in mathematical, scientific and engineering & technology fundamentals to solve engineering and technology related problems
10. To impart training on professional ethics, history, economics, social sciences and interactive skills relevant to professional practice
11. To provide a general perspective and opportunities for a career in industry, business and commerce

- **The Subject is being delivered to meet the highlighted objective of the course to meet the course aim.**

Why this Course– CSE

Refer to B. Tech. Computer Science and Engineering Course Specifications

The objectives of the course are:

1. To impart knowledge of computing and information technology systems and their subsystems
2. To develop understanding of the underlying logical, algorithmic, architectural and programming principles of computing systems
3. To build the ability to design and implement computing and information systems to meet the specific application needs
4. To model, simulate and analyse the behaviour of computing and information systems to predict and improve their performance
5. To impart training on processes and practice of software engineering life cycle
6. To train on industry standard simulation tools for simulation and analysis of electronic systems
7. To develop industry standard software systems
8. To provide a foundation in mathematical, scientific and engineering & technology fundamentals to solve engineering and technology related problems
9. To impart training on professional ethics, history, economics, social sciences and interactive skills relevant to professional practice
10. To provide a general perspective and opportunities for a career in industry, business and commerce

- **The Subject is being delivered to meet the highlighted objective of the course to meet the course aim.**

Why this Course– EEE

Refer to B. Tech. Electrical and Electronic Engineering Course Specifications

The objectives of the course are:

1. To impart knowledge on electrical and electronic systems and their subsystems
2. To enhance the understanding of the underlying engineering principles of electrical and electronic systems
3. To model, simulate and analyze the behaviour of electrical and electronic systems to predict and improve their performance
4. To design and build models of electrical and electronic systems to meet the specific needs
5. To impart training on instrumentation and testing of electrical and electronic systems
6. To train on industry standard simulation tools for simulation and analysis of electrical and electronic systems
7. To build and test electrical and electronic systems
8. To provide a foundation in mathematical, scientific and engineering & technology fundamentals to solve engineering and technology related problems
9. To impart training on professional ethics, history, economics, social sciences and interactive skills relevant to professional practice
10. To provide a general perspective and opportunities for a career in industry, business and commerce

The Subject is being delivered to meet the highlighted objective of the course to meet the course aim.

Why this Course– CE

Refer to B. Tech. Civil Engineering Course Specifications

The objectives of the course are:

1. To Impart knowledge on civil engineering systems and their subsystems
2. To enhance the understanding of the underlying engineering principles of civil engineering systems
3. To model, simulate and analyze the behavior of civil engineering systems to predict and improve their performance
4. To design and build civil engineering systems to meet the specific needs
5. To impart training on instrumentation and testing of civil engineering systems
6. To train on computer programming abilities and skills
7. To build and test civil engineering systems
8. To provide a foundation in mathematical, scientific and engineering & technology fundamentals to solve engineering and technology related problems
9. To impart training on professional ethics, history, economics, social sciences and interactive skills relevant to professional practice
10. To provide a general perspective and opportunities for a career in civil engineering, business and commerce

- **The Subject is being delivered to meet the highlighted objective of the course to meet the course aim.**

Course Aim and Summary

The subject introduces students to the basic concepts and techniques in real and complex analyses, matrix algebra and mathematical logic. Students are taught the concepts of derivative, continuity, limits, series expansion, functions and integrals of real and complex analysis. The utility of Cauchy's Integral and residue theorem in the evaluation of an integral is emphasized. The mathematical operations in Matrix theory, Eigen value and Eigen vector, Inversion and diagonalization of matrix and matrix solution for linear system of equations are discussed in this subject.

Course Intended Learning Outcomes

After undergoing this subject students will be able to:

1. Explain the principles of real analysis, complex analysis, matrix algebra
2. State and explain the important theorems such as Mean Value theorem, Taylor's theorem, Cauchy's Integral theorem
3. Solve simple mathematical problems associated with Real variables, Complex variables and Matrix algebra
4. Apply numerical methods to solve linear system of equations, algebraic and transcendental equations
5. Solve complex mathematical problems in matrix algebra, real and complex variables, system of equations and compare the results with that of solutions obtained through software tools

Course Content

- **Matrix Theory:**

Matrix Algebra, Special matrices, Determinants, Inversion. Row and Column Operations, Echelon form of Matrix. Solutions of System of Linear Equations – Existence and uniqueness of Solution, Gauss Elimination for non-homogenous Systems, Homogenous System of Linear Equations. Vector Spaces – Subspaces, Basis, Dimension, Linear Independence, Linear Transformations. Eigen Value Problems – Eigenvalues and Eigenvectors, Similar and Diagonalizable Matrices, Special Matrices and Quadratic Forms

- **Numerical Solution of Equations:**

Solution of algebraic and transcendental equations - root finding methods - Newton-Raphson method and its convergence, Numerical solution of linear system of equations – iterative methods: Gauss Jocobi and Gauss Seidel method

Method of Assessment

There are two components for assessment in this Subject:

Component - 1: 50% weight

It has two sub components

- Part A: Term Test: 25% Weight
- Part B: Assignment: 25% Weight

Two tests will be conducted one at the end of 6th week and the other at the end of the 12th week, the average of two tests will be the marks scored in term test for a maximum of 25 marks.

Student is required to submit two word processed assignments each assignment is set for 25 marks, the average of two assignments will be the marks scored in assignment for a maximum of 25 marks.

Method of Assessment Cont.

Component - 2: 50% weight

- A 2 hour duration semester end examination on Part – B using Matlab will be conducted for a maximum marks 50 and will be reduced to 25 marks.

- Another 2 hour duration semester end examination on Part – A will be conducted for maximum marks of 50 and will be reduced to 25 marks.

Method of Assessment Cont.

The assessment questions are set to test the learning outcomes. In each component certain learning outcomes are assessed. The following table illustrates the focus of learning outcome in each component assessed:

Intended Learning Outcome		1	2	3	4	5
Component – 1 (Term Test and Assignment)	A	X	X			
	B			X	X	X
Component – 2 (Examination)		X	X	X	X	X

Both components will be moderated by a second examiner. A student is required to score a minimum of 40% in each of the components and an overall 40% for successful completion of a module and earning the credits.

References

a. Essential Reading

1. Class Notes
2. Erwin Kreyszig (2007) Advanced Engineering Mathematics, Eighth Edition, John Wiley & Sons Inc.
3. R.K.Jain and S.R.K.Iyengar (2005) Advanced Engineering Mathematics, Second Edition, Narosa Publishing House.
4. Mott, Kandel and Baker (1986) Discrete Mathematics for Computer Scientists. McGraw Hill.

b. Recommended Reading

1. Peter V.O'Neil, (2007) Advanced Engineering Mathematics, Cengage Learning India Pvt. Ltd.

Course Delivery Schedule (Theory)

Number of Course Credits: 4 (3 Theory, 1 Tutorial)

Session No.	Date/Week	Time	Day	Topic	Delivered By	Additional Activity
1	Week 1			Introduction to Matlab and basic operations and 2D plots		
2	Week 2			Control structure in MATLAB		
3	Week 3			Row operations		
4	Week 4			Solutions to linear system – 1		
5	Week 5			Solutions to linear system – 2		
Week 6 1st term test						
6	Week 7			Vector spaces – Row, column and Null spaces		
7	Week 8			Eigenvalues and eigenvectors – 1		
8	Week 9			Eigenvalues and eigenvectors – 2		
9	Week 10			Solution of nonlinear equations by Newton – Raphson method		
10	Week 11			Iterative methods for linear systems: Gauss Jacobi and Gauss Seidal method		

Course Delivery Schedule (Theory)

Number of Course Credits: 4 (3 Theory, 1 Tutorial)

Session No.	Date/Week	Time	Day	Topic	Delivered By	Additional Activity
Week 12 2nd term test						
11	Week 13					
12	Week 14					
week 15 MATLAB Semester end Exam						

Theory Sessions

Lecture 1
Introduction to MATLAB

Intended Learning Outcomes

- Understand MATLAB desktop environment
- Understand basic syntaxes in MATLAB
- Do calculations at the command window
- Define & manipulate variables and characters
- Use built-in functions and define new functions
- Use script files
- Plot simple graphs

Lecture 2
Control Structures

Intended Learning Outcomes

- Illustrate various looping structures and their purpose
- Write simple codes involving specific looping structures

Lecture 3
Row Operations
Intended Learning Outcomes

- Perform elementary row operation on a matrix
- Reduce a matrix in row echelon form and reduced row echelon form
- Apply reduced row echelon form to find the inverse of the square matrix
- Compute the rank of matrix
- Apply MATLAB to find the reduced row echelon form

Lecture 4-5
Linear system
Intended learning outcomes

- Distinguish between homogeneous and non-homogeneous linear equations
- Represent the system of linear equations in matrix form
- Solution of linear system by Gauss elimination method and Gauss-Jordon method
- Solve the system of linear equations based on existence of solution

Lecture 6
Vector space, subspace, Basis, Dimension, Row Space, Column Space

Intended Learning Outcomes

- Illustrate the principles of vector spaces
- Illustrate the concept of subspaces
- Write the vectors in linear combination form
- Find the span of the vector space
- Distinguish linearly independent and linearly dependent
- Define and illustrate basis and dimension of a vector space
- Illustrate row space, column space and null space

Lecture 7-8
Eigen Values and Eigen Vectors

Intended Learning Outcomes

- Illustrate the eigenvalues and eigenvectors of a given square matrix
- Determine the eigenvalues and corresponding eigenvectors of a given matrix
- Apply eigenvalues and eigenvector in real world problems

Lecture 9
Newton Raphson Method
Intended Learning Outcomes

- Illustrate the steps involved in Newton-Raphson method
- Analyze the rate of convergence of the Newton-Raphson method

Lecture 10
Gauss-Siedel Method

Intended Learning Outcomes

- Illustrate the steps involved in Gauss-Jacobi method and Gauss-Seidel method
- Verify the strictly diagonally dominant for the system
- Solve the linear system by Gauss-Jacobi method and Gauss-Seidel method
- Solve systems of nonlinear equations with successive iterations