EMT1201: Engineering Mathematics II

Hours per Semester				Weighted Total Mark	Weighted Exam Mark	Weighted Continuous Assessment Mark	Credit Units
LH	PH	TH	CH	WTM	WEM	WCM	CU
45	00	30	60	100	60	40	4

Description

The course builds on Engineering Mathematics I and covers differential equations, infinite series, and real vector and numerical analysis. It also prepares the students for engineering mathematics III.

Objective

- To introduce students to the concept of Single Predictor-Response mathematical modeling in areas such as electrical circuit problems and vibratory and oscillatory mechanical systems
- To expose students to analytical solutions of classical ordinary differential equations in mathematical physics.
- To expose students to the fundamentals of Real Analysis.
- To introduce students the foundations of Scientific Computing and Numerical Analysis.

Learning Outcomes

On completion of this course the student will:

- Be able to formulate Ordinary Differential models associated with Electric Circuits
- Obtain analytical and numerical solutions of Ordinary Differential Equations;
- Have acquired the analytical ability critical to engineering problem solving

Content

Complex Number (variable) algebra:

Definition, properties (algebraic operations) & applications; Cartesian & polar representations; Absolute values; Products, powers and quotients; Extraction of roots; De-Moivre's theorem; exponential & hyperbolic functions of the complex variable.

Vector Algebra:

Scalars, vectors and their applications; Properties of vectors –addition, multiplication by scalars, dot & cross products; Vector products in terms of components; Application to analytic geometry –equation of lines, planes, spheres, etc; Physical applications –work done, normal flux, moments, force, angular velocity of rigid body; Coordinate systems and Transformation: Cartesian coordinates, Cylindrical Coordinates, Spherical coordinates. Vector Calculus: Differential length, Area and Volume. Vector Calculus: Line, surface and Volume integrals. Vector Calculus: Gradient, Divergence, Curl and Laplacian.

Linear transformations & matrix:

Definitions, equality, sum, product of matrices; types of matrices; the identity matrix, inverse of a matrix, transpose of matrix; Symmetric and skew symmetric matrices; Determinants – definition and properties, minors and cofactors, evaluation of determinants by cofactors; Solution of systems of linear algebraic equations; Consistent and inconsistent equations; Systems of homogeneous equations; Cramer's rule; Gauss –Jordan method.

Vector analysis:

Scalar and vector fields, vector functions, derivatives of vector functions; divergence and curl of vector functions; application of vector function concepts – line and surface integral, triple integrals and stokes theorems; Physical interpretation of divergence and curl of a vector field; Green's theorem, Line integrals independent of path; exact differential forms.

Real analysis:

Differentiability, the mean value theorem, Generalization of Taylor's series; Integrability, the definite and indefinite integrals, the fundamental theorem of calculus, differentiation and repeated integrals

Numerical analysis:

Numerical solutions of polynomial algebraic functions; interpolation formulae; numerical differentiation and integration; trapezoidal and Simpson's rules of integration; numerical solutions of ordinary differential equations; further consideration of integral equations by numerical methods

Reference books

- Martin M. Lipschutz, Theory and Problems of Differential Geometry, McGraw-Hill, 1969
- C. Ray Wylie and Louis C. Barrett, Advanced Engineering Mathematics, 6th ed., McGraw Hill, New York, 1995.
- Erwin Kreyszig, Advanced Engineering Mathematics, 8th ed., John Wiley and Sons.
- Murray R Spiegel, Theory and Problems of Vector Analysis, SI (Metric) ed., McGraw Hill
- Murray R. Spiegel, 1981. Applied Differential Equations. 3rd Edition. Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632