Foundation Course in Mathematics for First Degree Programme in Electronics

Semester I

Mathematics – I

Code: MM 1121.8

Instructional hours per week: 4
No. of Credits:3

Module 1: Differentiation with Applications (18 Hours)

(The following topics should be quickly reviewed before going to advanced topics; students should be asked to do more problems from exercises, and these problems should be included in assignments:) Differentiation of products of functions; the chain rule; quotients; implicit differentiation; logarithmic differentiation; Leibnitz theorem The following topics in this module should be devoted more attention and time. Special points of a function (especially, stationary points); curvature; theorems of differentiation – Rolles', Mean Value Theorems

The topics in this module can be found in chapter 2, sections 2.1.2, to 2.1.7, text [1] (Review of ideas through problems), chapter 2, sections 2.1.8, 2.1.9, 2.1.10, text [1] More exercises related to the topics in this module can be found in chapter 2 and chapter 3 of reference [1].

Module 2 : Integration with Applications (18 Hours)

Integration by parts; reduction formulae; infinite and improper integrals; plane polar coordinates; integral inequalities; applications of integration (finding area, volume etc)

The topics in this module can be found in chapter 2, sections 2.2.8 to 2.2.13, text [1] More exercises related to the topics in this module can be found in chapter 4, chapter 5 and chapter 7 of reference [1].

Module 3 : Complex numbers and Hyperbolic functions (18 hours)

Basic operations (Addition and subtraction; modulus and argument; multiplication; complex conjugate; division), Polar representation of complex numbers (Multiplication and division in polar form), de Moiver's theorem (trigonometric identities; finding the nth roots of unity; solving polynomial equations), Complex logarithms and complex powers, Applications to differentiation and integration, Hyperbolic functions (Definitions; hyperbolic trigonometric analogies; identities of hyperbolic functions; solving hyperbolic equations; inverses of hyperbolic functions; calculus of hyperbolic functions)

The topics in this module can be found in chapter 3, sections 3.1 to 3.7 of text [1] More exercises related to the topics in this module can be found in chapter 6 of reference [1] and chapter 13 of text [2].

Module 4 : Fourier series and Laplace transforms (18 Hours)

Fourier series - Basic definition, Periodic Functions, Fourier Coefficients, Dirichlet Conditions, Even and Odd Functions, Half range series.

Laplace Transforms - Definition, Properties (Linearity property, Shifting property, Multiplication by powers of *t*, Laplace transform of derivatives), Simple problems.

The topics in this module can be found in chapter 6 and chapter 11 of text [2].

Texts

Text 1 – K F Riley, M P Hobson, S J Bence. Mathematical Methods for Physics and Engineering, 3rd Edition, Cambridge University Press

Text 2 – Erwin Kreyszig. Advanced Engineering Mathematics, 10th Edition, Wiley-India

References

Ref. 1 – H Anton, I Bivens, S Davis. Calculus, 10th Edition, John Wiley & Sons

Ref. 2 – Mary L Boas. Mathematics Methods in the Physical Sciences, 3rd Edition, Wiley

Ref. 3 – George B Arfken, Hans J Weber, Frank E Harris. Mathematical Methods for Physicists, 7th Edition, Academic Press

Semester II

Mathematics – II

Code: MM 1221.8

Instructional hours per week: 4
No. of Credits: 3

Module 1 : Vector Algebra (18 Hours)

Scalars and vectors, Addition and subtraction of vectors, Multiplication by a scalar, Basis vectors and components, Magnitude of a vector, Multiplication of vectors (Scalar product; vector product; scalar triple product; vector triple product), Equations of lines, planes and spheres, using vectors to find distances (Point to line; point to plane; line to line; line to plane)

The topics in this module can be found in chapter 7, sections 7.1 to 7.8, text [1] More exercises related to the topics in this module can be found in chapter 11 of reference [1] and chapter 6 of reference [2].

Module 2 : Partial Differentiation (18 Hours)

Basics, The total differential and total derivative, Exact and inexact differentials, theorems of partial differentiation, The chain rule, Change of variables, Taylors theorem for many-variable functions, Stationary values of many-variable functions, Stationary values under constraints

The topics in this module can be found in chapter 5, sections 5.1 to 5.9 of text [1] More exercises related to the topics in this module can be found in chapter 13 of reference [1]

Module 3 : Multiple Integrals (18 Hours)

Double integrals, Triple integrals, Applications of multiple integrals (Areas and volumes), Change of variables in multiple integrals – Change of variables in double integrals; evaluation some special infinite integrals, change of variables in triple integrals; general properties of Jacobians

The topics in this module can be found in chapter 6, sections 6.1 to 6.4 of text [1] More exercises related to the topics in this module can be found in chapter 14 of reference [1].

Module 4 : Vector Differentiation (18 Hours)

Differentiation of vectors , Composite vector expressions; differential of a vector, Integration of vectors, Space curves, Vector functions of several arguments, Surfaces, Scalar and vector fields Vector operators, Gradient of a scalar field; divergence of a vector field; curl of a vectorfield , Vector operator formulae, Vector operators acting on sums and products; combinations of grad, div and curl, Cylindrical and spherical polar coordinates

The topics in this module can be found in chapter 10, sections 10.1 to 10.9 of text [1]. More exercises related to the topics in this module can be found in chapter 3 of reference [3].

Texts

Text 1 – K F Riley, M P Hobson, S J Bence. Mathematical Methods for Physics and Engineering, 3rd Edition, Cambridge University Press

References

Ref. 1 – H Anton, I Bivens, S Davis. Calculus, 10th Edition, John Wiley & Sons

Ref. 2 – Mary L Boas. Mathematics Methods in the Physical Sciences, 3rd Edition, Wiley

Ref. 3 – George B Arfken, Hans J Weber, Frank E Harris. Mathematical Methods for Physicists, 7th Edition, Academic Press

Ref. 4 – Erwin Kreyszig. Advanced Engineering Mathematics, 10th Edition, Wiley-India

Complementary Course in Mathematics for First Degree Programme in Electronics

Semester III

Mathematics – III

Code: MM 1331.8

Instructional hours per week : 3
No. of Credits : 3

Module 1 : Ordinary Differential Equations of First order (12 Hours)

First-order ordinary differential equations : General form of solution, First-degree firstorder equations (Separable-variable equations; exact equations; inexact equations, integrating factors; linear equations; homogeneous equations; isobaric equations; Bernoullis equation; miscellaneous equations) Higher-degree first-order equations (Equations soluble for p; for x; for y; Clairaut's equation)

The topics in this module can be found in chapter 14 and chapter 15 of text [1] More exercises related to the topics in this module can be found in chapter 1, 2 and 3 of reference [1].

Module 2 : Higher order Ordinary Differential Equations (18 Hours)

Higher-order ordinary differential equations : Linear equations with constant coefficients, (Finding the complementary function yc(x); finding the particular integral yp(x); constructing the general solution yc(x)+yp(x); linear recurrence relations; Laplace transform method) Linear equations with variable coefficients (The Legendre and Euler linear equations; exact equations; partially known complementary function; variation of parameters; Green's functions; canonical form for second-order equations)

General ordinary differential equations – Dependent variable absent; independent variable absent; non-linear exact equations; isobaric or homogeneous equations; equations homogeneous in x or y alone; equations having y = Aex as a solution

The topics in this module can be found in chapter 14 and chapter 15 of text [1] More exercises related to the topics in this module can be found in chapter 1, 2 and 3 of reference [1].

Module 3 : Basic Linear Algebra (24 Hours)

Matrices and row reduction, Determinants, Cramer's rule for solving system of equations, vectors, lines and planes, linear combinations, linear functions, linear operators, linear dependence and independence, special matrices like Hermitian matrices and formulas, linear vector spaces, eigen values and eigen vectors, diagonalizing matrices, applications of diagonalization

The topics in this module can be found in chapter 3 of text [2] More exercises related to the topics in this module can be found in chapter 7 and 8 of reference [1].

Texts

Text 1 – K F Riley, M P Hobson, S J Bence. Mathematical Methods for Physics and Engineering, 3rd Edition, Cambridge University Press

Text 2 – Mary L Boas. Mathematics Methods in the Physical Sciences, 3rd Edition, Wiley

References

Ref. 1 – Erwin Kreyszig. Advanced Engineering Mathematics, 10th Edition, Wiley-India

Ref. 2 – H Anton, I Bivens, S Davis. Calculus, 10th Edition, John Wiley & Sons

Ref. 3 – George B Arfken, Hans J Weber, Frank E Harris. Mathematical Methods for Physicists, 7th Edition, Academic Press