Syllabus for the Complementary course in Mathematics for the First Degree Programme in Physics and Computer Application

UNIVERSITY OF KERALA

Semester I

MATHEMATICS I
(Calculus, Infinite Series and Vector Algebra)
Code: MM1131.6

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

MODULE 1

Differentiation and its Applications  
18 Hours
Differentiation (a review) - Leibnitz theorem - Special points of a function - Curvature - Theorems of Differentiation - Mean Value Theorem - Rolle’s Theorem.

*The topics in this module can be found in Chapter 2, sections 2.1 of 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 and its Applications  
18 Hours
Integration by parts - Reduction formulae - Infinite and Improper Integrals - Plane polar coordinates - Integral inequalities - Applications of Integration (Mean Value of function, Length of Curve, Surface Area of revolution, Volume of revolution.)

*The topics in this module can be found in Chapter 2, sections 2.2.8 to 2.2.13 of 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

Infinite Series  
18 Hours

*The topics in this module can be found in Chapter 4, sections 4.1 to 4.6 of Text [1].

More exercises related to the topics in this module can be found in Chapter 9 of Reference [1] and Chapter 1 of Reference [2].

MODULE 4

Vector Algebra  
18 Hours
Scalar Triple Product - Vector triple product - Equations of lines, planes and spheres - Using vectors to find distances - Reciprocal vectors

*The topics in this module can be found in Chapter 7, sections 7.6 to 7.9 of 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].
Text

References

*****
Syllabus for the Complementary course in Mathematics for the First Degree Programme in Physics and Computer Application

UNIVERSITY OF KERALA

Semester II

MATHEMATICS II
(Parial Differentiation, Vector Differentiation, Complex Numbers and Multiple Integrals)
Code: MM1231.6

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

MODULE 1

Partial Differentiation
18 Hours

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 2

Vector Calculus - Differentiation
18 Hours

Differentiation of vectors - Differentiation of 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 vector field - Vector operator formulae - Vector operators acting on sums and products - Combinations of grad, div and curl - Cylindrical and spherical polar coordinates - Cylindrical polar coordinates - 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].

MODULE 3

Complex Numbers
18 Hours

de Moivress Theorem - Trigonometric identities - Finding the nth roots of unity - Solving polynomial equations - Complex logarithms and complex powers - Applications to differentiation and integration - Hyperbolic functions - Inverses of hyperbolic functions - Calculus of hyperbolic functions.

The topics in this module can be found in Chapter 3, sections 3.4 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 Reference [4].

MODULE 4

Multiple Integrals
18 Hours

Double integrals - Triple integrals - Applications of multiple integrals - Areas and volumes only (Masses, centres of mass and centroids - Pappus theorems - Moments of inertia - Mean values of functions are excluded) - Change of variables in multiple integrals - Change of variables in double...
integrals- Evaluation of 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] and Chapter 6 of Reference [2].

Text


References


Syllabus for the Complementary course in Mathematics for the First Degree Programme in Physics and Computer Application

UNIVERSITY OF KERALA

Semester III

MATHEMATICS III
(Theory of Matrices, Vector Integration, Differential Equations and Fourier Series)
Code: MM1331.6

Instructional hours per week: 5
No. of Credits: 4

MODULE 1
Theory of Matrices
24 Hours

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 Text [3].
This topics can be referred in Reference [4].

MODULE 2
Vector Calculus - Integration
18 Hours
Evaluating Line integrals - Physical examples of line integrals - Line integrals with respect to a scalar - Connectivity of regions - Greens theorem in a plane - Conservative fields and potentials - Surface integrals - Evaluating surface integrals - Vector areas of surfaces - Physical examples of surface integrals - Volume integrals - Volumes of three-dimensional regions - Integral forms for grad, div and curl - Greens theorems (without proof) - Other related integral theorems - Physical applications of the divergence theorem - Stokes theorem and related theorems (without proof) - Related integral theorems - Physical Applications.

The topics in this module can be found in Chapter 11 of Text [1].

More exercises related to the topics in this module can be found in Chapter 3 of Text [2].

MODULE 3
Differential Equations
30 Hours
First Order Ordinary Differential Equations - Exact ODEs. Integrating Factors - Linear ODEs - Bernoulli Equation - Orthogonal Trajectories - Homogeneous Linear ODEs with Constant Coefficients - EulerCauchy Equations, Nonhomogeneous ODEs.

The topics in this module can be found in Chapter 1 and 2, sections 1.4, 1.5, 1.6, 2.2, 2.5 and 2.7 of Text [3].

More exercises related to the topics in this module can be found in Chapter 8 of Text [2] and Reference [2].
MODULE 4
Fourier Series and Fourier Transforms

18 Hours

Introduction - Simple Harmonic Motion and Wave Motion - Periodic Functions - Applications of Fourier Series - Average Value of a Function - Fourier Coefficients - Dirichlet Conditions - Complex Form of Fourier Series - Other Intervals - Even and Odd Functions - Parsevals Theorem - Fourier Transforms.

The topics in this module can be found in Chapter 7 of Text [2].

More exercises related to the topics in this module can be found in Chapter 11 of Text [3].

Text

References

*****
Syllabus for the Complementary course in Mathematics for the First Degree Programme in Physics and Computer Application

UNIVERSITY OF KERALA

Semester IV

MATHEMATICS IV
(Abstract Algebra, Laplace Transforms, Special Functions and Functions of A Complex Variable)
Code: MM1431.6

Instructional hours per week: 5  No. of Credits: 4

MODULE 1
Abstract Algebra
30 Hours
Groups - definition and Examples - Elementary properties - Finite Groups and Subgroups - Cyclic Groups - Elementary Properties
Rings - definition and Examples (Finite and Infinite) - Integral Domain and Field - definition and examples (Finite and Infinite)

The topics in this module can be found in Text [1].

More exercises related to the topics in this module can be found in Reference [1].

MODULE 2
Laplace Transforms and its Applications
24 Hours
Laplace transforms - Elementary Functions - Inverse Transform - Partial Fraction Expansion - Laplace transforms of derivatives - Dirac Delta Function (excluded) - Other Properties - Translation - Derivative of a Transform - Integration of Transforms - Limits of Integration - Unit Step Function - Convolution (Faltung) Theorem - Inverse Laplace transforms.

The topics in this module can be found in Chapter 15, sections 15.8 to 15.12 of Text [2].

More exercises related to the topics in this module can be found in Reference [2].

MODULE 3
Special Functions
18 Hours
The Factorial Function - Definition of the Gamma Function - Recursion Relation - The Gamma Function of Negative Numbers - Some Important Formulas Involving Gamma Functions - Beta Functions - Beta Functions in Terms of Gamma Functions.

The topics in this module can be found in Chapter 11 of Text [3].

More exercises related to the topics in this module can be found in chapter 13 of Text [2].

MODULE 4
Functions of A Complex Variable
18 Hours

The topics in this module can be found in Chapter 14, sections 1 to 8 of Text [3].

More exercises related to the topics in this module can be found in Chapter 14, 15 and 16 of Reference [2]
Text

1 John B Fraleigh *A first course in Abstract Algebra*, Narosa Publications.


References

1 D A R Wallace *Groups, Rings and Fields*, Springer.


*****