

**DEPARTMENT OF MATHEMATICS  
UNIVERSITY OF IBADAN**

**COORDINATOR: DR O.O UGBEBOR**  
**DEPUTY COORDINATOR: DR M. ENIOLUWAFE**

**History**

Courses in Statistics and Computer Science were taught in the Department of Mathematics until the mid seventies when separate Departments of Statistics and Computer Science were created.

The Department of Mathematics offers courses for the following categories of undergraduate students:

- a. Single Honours Mathematics students leading to the degrees of B.Sc. and B.A.
- b. Education Students in the Departments of Teacher education, Adult Education, Guidance and Counselling and Educational Management reading Mathematics as a major or minor teaching subject.
- c. Service courses to students in the Department of Physics, Statistics, Computer Science, Chemistry and all Engineering students offering Mathematics courses at the 100, 200 and 300 levels.
- d. Other categories of students in the Faculties of Science, Social Sciences, Education and Agriculture who offer Supplementary Mathematics.

The Department of Mathematics formally started the postgraduate programme in 1961 and at the moment, we receive more applications from those wishing to do postgraduate studies than those at the undergraduate level. Most of the Mathematics graduates of other Nigerian Universities wishing to pursue postgraduate work apply to Ibadan to study areas of Pure and Applied Mathematics such as Algebra, Algebraic K-Theory, Functional Analysis, Algebraic Topology/Geometry, Ordinary and Partial Differential equations and Numerical analysis.

**100 Level**

<b>Course Code</b>	<b>Course Title</b>	<b>Units</b>	<b>Status</b>
MAT 111	Algebra	4	R
MAT 121	Calculus and Trigonometry	4	R

***Note: 100 Level mathematics courses are to be taken by 100 level Statistics Students in the Department of Statistics***

***Distribution of Courses***

**200 Level**

<b>Course Code</b>	<b>Course Title</b>	<b>Units</b>	<b>Status</b>
MAT 211	Abstract Algebra	4	R
MAT 213	Algebra I		
MAT 221	Analysis I	4	R

MAT 241	Ordinary Differential Equations	4	R
		<b>12</b>	
<b>300 Level</b>			
MAT 212	Linear Algebra	4	R
MAT 222	Analysis III	4	R
MAT 242	Vectorial Mechanics	4	R
		<b>12</b>	
<b>400 Level</b>			
MAT 311	Group and Rings	4	R
MAT 321	Analysis II	4	R
MAT 331	Differential Geometry	4	R
MAT 341	Mathematical Methods I	4	R
MAT 342	Mathematical Methods II	4	R
MAT 352	Probability Distribution & Elementary Limit Theories	4	R
MAT 351	Numerical Analysis	4	E
		<b>20</b>	
<b>500 Level</b>			
MAT 312	Theory of Modules	4	R
MAT 322	Analysis IV	4	R
MAT 323	Complex Analysis	4	R
MAT 342	Mathematical Methods II	4	R
MAT 343	Vectors & Tensors	4	R
		<b>12</b>	

**Course Details**

Course No.	Course Title and Description	Units	Status
MAT 111	<p><b>Algebra</b></p> <p>Polynomials. The Remainder and Factor Theorems. Polynomial Equations and Inequalities especially linear, quadratic and cubic. Domain and Zeroes of Rational Functions. Partial Fractions. Curve Sketching of Polynomial and Rational Function.</p> <p>The principle of mathematical induction and its application, to properties of Natural Numbers. Permutations and Combinations. The Binomial Theorem for any index and applications. Sequences, Series. A.P., G. P. Limits and sums to Infinity. First and Second Differences of a Sequence. Addition, Subtraction, Multiplication and Division of Complex Numbers. Fundamental Theorem of Algebra (statement only). The Argand Diagram De-Moivre's Theorem. N-th roots of complex numbers</p> <p>Introduction to <math>m \times n</math> matrices where</p>	4	R

	<p><math>m, n \leq 5</math>. Elementary Operations on Matrices and Applications 10 solution of Linear Equations Elementary properties of Determinants of at most <math>3 \times 3</math> matrices.</p> <p>Transformations of the Plane: Translation: Reflection: Rotation: Enlargement: Composition of transformations Invariant Points and Lines.</p>		
MAT 121	<p><b>Calculus and Trigonometry</b></p> <p>Functions: Concept and notation: Polynomial and Rational Functions. Trigonometric functions. Exponential/logarithms functions. Functional linear equations. Idea of Limits: Techniques of finding limits. <b>Derivatives:</b> Definition and Calculation from first principles: Derivatives of constants, powers, sums, products, quotients, composite functions: implicit functions, polynomial and rational functions, inverse functions: circular functions, logarithmic/exponential function. Higher order derivatives. Applications: Small increments, approximations and errors. <b>Extreme Integration:</b> as the inverse of differentiation, as area, as limit of finite sum. Integration of sum/scalar multiple of functions with applications: Integration of circular functions. Definite Integrals: General properties of definite integral. Some applications to Geometry.</p>	4	R
MAT 213	<p><b>Algebra I</b></p> <p>Sets, relations, mappings, order. Groups, rings Integral domains, fields, fundamental theorem of arithmetic, polynomials in single variable. Theory of equations, inequalities. Vector spaces, Linear dependence and basis and dimension. Linear mappings, rank nullity. Algebra of matrices, elementary operations on matrices, determinants. Linear equations, Eigenvalues and eigenvectors. Similarity to diagonal matrices. Boolean algebra with applications.</p>	4	R
MAT 211	<b>Abstract Algebra</b>	4	R

	Sets relations, equivalence relations mapping, order (partial order; total order; well ordering) lattices (definitions and examples). Binary operations, homomorphism of groupoid, fundamental algebraic structures – semi-groups, monoids, groups rings, integral domains, skew fields, fields – definitions, examples and elementary properties. Number systems elementary number theory, divisibility and primes, euclid's algorithm congruencies, Polynomials in single variables, factorization partial functions.		
MAT 221	<b>Analysis I</b> Sets, Real and complex numbers. Convergence and divergence of sequences and series of complex numbers	4	R
MAT 241	<b>Ordinary Differential equations</b> Derivation of equations from Physics, Geometry, etc: Techniques for solving first and second order linear and non-linear equations, and for solving nth order linear equations, Finite differences and difference equations; Interpolation; errors; Solution of equations; elementary numerical integration.	4	R
	<b>Total Units</b>	<b>12</b>	

MAT 212	<b>Linear Algebra</b> Vector spaces, subspaces, sum and direct sum of spaces, linear independence, basis and dimensions. Linear mappings, kernel, image, rank, nullity of linear mappings. Matrix of a linear mapping. Algebra of matrices. Elementary operations on matrices echelon forms, row/column rank of matrix. Determinants (elementary properties). Laplace expansion of determinant, matrix inverses. Linear equation, homogenous and non-homogenous systems, eigen values and eigen vector s. Similarity to diagonal and triangular matrices.	4	R
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MAT 222	<b>Analysis III</b> Topology of $R^n$ , continuous mappings, Homomorphism, Invariants of continuous mappings, uniform continuity, Weierstrass	4	R
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	theorem.		
MAT 242	<b>Vectorial Mechanics:</b> Vectors in euclidean spaces; Vector products; equations of lines and planes; elements of vector calculus; General kinematics; Momentum; Angular momentum; energy and conservation laws; Dynamics of particle and of a rigid body.	4	R
	<b>Total Units</b>	12	

MAT 311	<b>Group and Rings</b> Groups, subgroups, cyclic groups, Lagrange's theorem normal subgroups, quotient groups, Isomorphism theorem. Symmetric groups, Cayley's theorem group acting on sets, Sylow theorems, commutators, direct product, composition series, Rings, quotient rings, Isomorphism theorem, Prime and maximal ideal, principal ideal domains, euclidean domains, unique factorization domains.	4	R
MAT 321	<b>Analysis II</b> Mappings, functions of real variables, continuity and differentiability. Taylor's theorem extensions and applications. Introduction to Riemann integration.	4	R
MAT 331	<b>Differential Geometry</b> Curves, Frescent formulae, natural equation, isoperimetry, Local surfaces, fundamental forms, Levi-civita parallelism, Normal curvature, Gaussian curvature, Minimal surface, geodesics, isometrics, Global surface, Gauss-Bonnet theorem, shortest connecting curves, convex surfaces.	4	R
MAT 341	<b>Mathematical Methods I</b> Linear dependence; Wronskian; Reduction of order; Variation of Parameters; Series solutions about ordinary and regular points; Special functions; Bessel, Legendre, hypergeometric, etc. Laplace transforms and applications to initial value problem.	4	R
MAT 352	<b>Probability Distributions and elementary Limit Theories</b> Continuous random variables, indicator function, Movement-generating function, Stochastic independence, Distribution of sum of independent random variables, continuous distributions, change of variables technique, Random samples characteristic functions, Mode of	4	E

	convergence, elementary limit Theorems.		
MAT 342	<p><b>Mathematical Methods II</b> Sturm-Liouville problem Orthogonal polynomials and functions. Fourier series and integrals.</p> <p>Partial differential Equations: First and Second order equations: Classifications of second order linear equations: Solutions of the heat, wave and Laplace equations by the method of separation of variables, eigenfunction expansions, and Fourier transforms.</p>		
MAT 351	<p><b>Numerical Analysis:</b> Numerical differentiation and integration. Solution of ordinary differential equations. Direct and iterative methods for solution of linear systems. Least square polynomial approximations Introduction to numerical solution of partial differential equations.</p>		

MAT 312	<p><b>Theory of Modules</b> Modules, direct sum products, submodules, quotient modules, isomorphism theorems, Polynomials and power series in several variables, symmetric polynomials, Finitely general modules over principal ideal domains with application to abelian groups. Bilinear and quadratic forms, Multi-linear algebra, Tensors, exterior and symmetric products.</p>	4	R
MAT 322	<p><b>Analysis IV</b> Differentiation, derivatives, directional derivatives, partial derivatives and higher order derivatives, Taylor's theorem, Inverse function theorem, Implicit function theorem, extrema and method of Lagrange multipliers, Riemann integrals, Riemann-Stiefjes integral, functions of bounded variation, Partial integration formula, Mean value theorems, integration of functions of several variables.</p>	4	R
MAT 323	<p><b>Complex Analysis</b> Limits and continuity of function of a complex variable, Analytic functions complex integrations, cauchy's theorem and its converse, cauchy's integral. Derivative theorems, Taylor's and Laurent's theorems, classification of singularities, convergence of sequence and series of complex functions</p>	4	R

	(including power series and characterisation of analytic functions by power series). Residues, Cauchy's residue theorem, evaluation of definite integrals, conformal Transformations.		
MAT 342	<b>Mathematical Methods II</b> Sturm-Liouville problem, Orthogonal polynomials and functions, Fourier series and integrals.  Partial differential equations; First and Second order equations; classifications of second order linear equations; Solutions of the heat, wave and Laplace equations by the method of separation of variables, eigenfunction expansions, and Fourier transforms	4	R
MAT 343	<b>Vectors and Tensors</b> Revision of elementary vector algebra; Index notation, Differentiation of vectors, Gradient; Divergence; curl Line, surface, and volume integrals; Divergence Theorem; Green's Theorem Stokes' theorem; Cartesian Tensors; Transformation law; Gauss Theorem; the quotient rules.	4	R
<b>Total Units</b>		<b>12</b>	

<b>Summary</b>		
<b>Level</b>	<b>Status</b>	<b>Units</b>
200	Compulsory	
	Required (4)	16
	Elective (-)	-
		<b>16</b>
<b>Level</b>	<b>Status</b>	<b>Units</b>
300	Compulsory	
	Required (3)	12
	Elective	
		<b>12</b>
<b>Level</b>	<b>Status</b>	<b>Units</b>
400	Compulsory	
	Required (4)	16
	Elective (1)	2
		<b>18</b>
<b>Level</b>	<b>Status</b>	<b>Units</b>
500	Compulsory	
	Required (5)	20
	Elective	
		<b>20</b>
<b>Total no =</b>		<b>65</b>

