**Department of Mathematics**

**DESCRIPTION OF THE PROGRAMME**

Mathematics has been the dynamic business environment around the world. It is designed to provide exceptional cutting edge knowledge for School and Open and Distance Learning suited for Mathematics programmes. The programme is designed to provide functional, cost effective, flexible learning which adds life-long value to quality education for all who seek knowledge.

BEd. Mathematics is designed to produce graduates who are well grounded in the Knowledge of Mathematics and who are adequately equipped to manage the private sector as well as the public sector business environment. The programme is also designed to produce graduates who can compete favourably with their counterparts in the global market as well as undertake post graduate programme leading to the award of Post Graduate Diploma in Mathematics (PGD), Master of Mathematics.

Admission and registration procedure are Online Based. Students are required to purchase their Admission forms from any of the nominated banks and then fill the form and submit Online. Admission list as well as individual student’s admission letter for successful candidates is published on GNOU website. Students are also expected to complete their procedure Online.

The programme is designed for the facilitation of learners in Mathematics as well as to produce manpower for development and to educate future leaders in the calculation and related fields of study or prepare them for managerial positions.

**ADMISSION REQUIREMENTS**

**(Mathematics, BEd**)

**Examination Types**

A minimum of 5 credits from WAEC/SSCE or NECO.

**Required Subjects**

English, Mathematics, Economics and two others at not more than two sittings.

Five credit passes in the GCE or equivalent examination, at least two of which shall be at the Advanced level or four credit passes at least three of which shall be at the Advanced level. Credit passes at the Ordinary Level must include English Language and Mathematics.

**Minimum Grade**

Credit passes (C6)

**PLUS**

ND (Upper Credit),

HND (Lower Credit) or

Final Certificate of relevant Professional Bodies in addition to five credit passes

**PROGRAMME REQUIREMENTS**

**Programme Structure**

Minimum duration of the Bachelor of Science (BEd.) Degree in Mathematics programme is four years of eight semesters and a maximum of eight years (of sixteen semesters) under flexible mode of study.

**Degree Rules**

To be awarded BEd. Degree in Mathematics, the student must pass a minimum of 120 credit units for UME or 90 credit units for direct entry. The minimum credit units include all compulsory courses and research project and exclude all general studies courses.

**COURSE CONTENT SPECIFICATIONS/SYLLABUS OF ALL COURSES IN THE PROGRAMME**

The following course contains codes, titles and units that will help the students to understand the number of compulsory courses to pass per semester and lecturers to know the kind of the units to teach the students. **Students are expected to choose one (1) out of the two available electives**

**OUTLINE OF COURSE STRUCTURE**

Minimum duration of the BEd. Degree in Mathematics Programme is four years of eight semesters and a maximum of eight years (of sixteen semesters) under flexible mode of study.

**COURSE CONTENT SPECIFICATION**

**MAT 111 Algebra and Trigonometry 3C**

Sets, subsets, union, intersection, null and universal sets, complements, Venn diagrams. Real numbers, integers, rational and irrational numbers. Mathematical induction. Sequences and series. Theorem, complex numbers – algebra of complex numbers, the argand diagram, De moivire's theorem, nth root of unity, Circular measure, Trigonometric identities, General solution of trigonometric equation. Graphs of tigo-nometric functions.

**MAT 112 Vectors: Geometry and Dynamics 3C**

Geometric representation of vectors in I to 3 dimensions, Components of a vector. Triangle. Parallelogram and Polygon laws of vector addition. Resultant of vectorsscalar multiplier of vectors, linear independence. Scalar and vector products. Direction consines. Application to geometry. Differentiation and integration of vectors with respect to a scalar variable. Two-dimensional coordinate geometry, straight lines, circles, parabola ellipse, hyperbola, tangents, normals. Kinematics of a particle. Components of velocity and acceleration of a particle moving in a plane. Force, momentum, laws of motion under gravity, projectiles, resisted vertical motion clastic string, simple pendulum, impulse. Impact of two smooth spheres and of a sphere on a smooth surface.

**MAT 121 Introductory Statistics 3C**

Frequency distributions: Class intervals, class limits, class boundaries etc. Pictorial representation of data (Bar charts, pie charts, Histograms etc.)Cumulative frequency, ogives. Measures of central tendency (mean; median; mode): quartile, percentileetc), Measures of dispersion. Moments, skewness and Kurtosis.

**MAT 122 Calculus 3C**

Function of a real variable, graphs, limits and idea of continuity. The slope of a curve. The derivative of a continuous function. Differentiation from first principle (algebraic and trigonometric functions). Derivatives of algebraic, trigonometric, logarithmic, exponential and hyperbolic functions. The sum, products and quotient rules. The chain rule, Derivatives of implicit function and of a function of a function. Applications of differentiation, local and absolute maximum and minimum values of a function. Small changes and calculation of approximate values. The differentiation of functions represented parametrically, Rates of change and linear Kinematics. Integration.-As inverse of differentiation. Indefinite integral. Definite integral and its representation' as an area. Integration of simple algebraic and trigonometric functions. Applications to geometry and mechanics. Approximate integration using trapezoidal and Simpson's rules. Applications of integration.

**MAT 211 Mathematical Methods 1 3C**

Real-valued functions of a real variable. Review of differentiation and integration and their applications, mean value theorem. Taylor’s series. Real value functions of two or three variables, partial derivatives chain rule, extreme Lagrange's multipliers, increments, differentials and linear approximations, evaluation of line integral. Multiple integrals.

**MAT 212 Real Analysis I 3C**

Basic properties of Real numbers system including boundedness and completeness. Open and closed sets, Neighbourhood Theorems on open and closed sets. Functions of Real analysis variables.

**MAT 214 Statistics 1 3E**

Simple spaces, Definition of probability of finite sample space with examples. Probability as proportion of areas. Conditional probability of events, independence, tree diagrams, variables, and cumulative frequency distributions, means, variance. Conditional expectation and linear correlation using scatter diagram.

**MAT 221 Elements of Computer Science 3C**

Historical development of the computer, Essential components of the computer and their functions, number presentation in a computer, Data structures and their uses in a computer, computer software and types of software, flow-charts, flow charting and symbols,. Algorithms, Pseudocodes, programs, programming Languages programming Techniques. An overview of the world of computer. Computer evolutions from abacus to the modem computer. Types (micro, mini, mainframe and super classes,(Analogue, digital and hybrid).

**MAT 222 Real Analysis 11 3R**

Functions of Real Variables Differentiations and Talor's theorem, partial derivations and higher order derivatives, languages multipliers. Riemann-integral. Riemann-Stielties Functions of bounded variation. Partial integration formula. Means value theorem of Integration.

**MAT 223 Linear Algebra I 3R**

Matrices; Definition and types of Matrics. Addition and subtraction of Matrices. Scalar multiplication. Properties of matrix addition. Multiplication of matrices. Properties of matrix multiplication, matrices and Elementary, Row operations. Determinations: Definition and properties of determinants. Adjoint and inverse of a metrix Crammer's rule. Systems of Linear Equations. Linear equations. Systems of Line are quations. Solution of systems of linear equations. Crammer's rule.

**MAT 224 Differential Equations I 3R**

First order ordinary differential equations. Existence and uniqueness. Second order ordinary differential equations with constant co-efficients. Gener~I theory of nth order linear equations.

**MAT 225 (Methodology 1) 3C**

The nature of mathematics, its objectives and content at the junior and senior secondary schools. Methods of teaching mathematics in Junior and Senior Secondary Schools. Teaching and learning materials in junior and senior secondary schools. Planning and teaching of mathematics lessons. Micro-teaching Evaluation techniques in mathematics teaching. Contributions of Piaget, Bruner, Gagne, Dienes, etc. to mathematics learning. Brief history of Mathematics: Development of mathematics in an-

cient times, middle ages and the renaissance period. Some prominent mathematicians and their contributions.

**300 LEVEL MAT**

**MAT 311 (Mathematical Methods II) 3R**

Revision of Differential Equations 1: Dengendre's Equations, Polynomials, Generating functions, Bessel's Equation. Boundary values problems and Unitial value problems Buler's Equation, Laplace', equation. Wave Equation, Diffusion Equation.

**MAT 321(Complex Analysis I) 3C**

Functions of a Complex Variables: Limits and continuity.

Review of topological concepts: Analytic functions power series. Ratical function. Exponential, trigonometric and logarithmic functions general, power, elementary conformal representation bilinear transformation. Complex integration: Line integral, cauchy's theorem with proof for a tangle. Caicjy's integral; formula. The derivatives of analytic functions. Taylor and Laurent series. Zeros and singularities of nalytic function. The maximum modulus principle. Calculus of Residues: Caucy's residue theorem, the argument principle. Fundamental theorem of algebra. Evaluation of definite integrals. Expansion of functions as series of partial fraction. Uniform Convergence: Uniformly convergent sequences and series of Analytical functions and their properties. Infinite Products. Absolute and uniform convergence of infinite products. Caucy's form for products as series.

**MAT 313 (Abstract Algebra 11) 3R**

Kings: Definitio1 and elementary properties of kings. Subrings, ideals. Quotient rings. Hoinonorphism. Monomorphism, Epimorphism and Isomorphism of rings, Isomorphism theorems. Prime and maximal ideals. Eucludean Rings. Unique factorisation Domains. Primary ideal Domains, Boolean Ring. Integral Domains. Division Rings. Fields: Definitions and elementary properties of Fields only subfields. Homomor-Reducible and irreducible polynomials. The GCD., and D.C.M. of polynomials. Euclidean division Algorithm for Polynomials. Unique Factorisation theorem. Eisenstein Irreducibility criterion.

**MAT 314 (Methodology 11) 3C**

Problems of Mathematics teaching in the Junior and Senior Schools. Common errors in Mathematics. Diagnosis and Remediation of difficulty in Mathematics. Diagnosis and Remediation of difficulty in Mathematics learning. Questioning techniques (including types and functions of questions). Discovery approaches problem solving in mathematics Polya’s principles of teaching mathematics. Application of problem solving approaches to problems from J.S.S., S.S.S. and further mathematics curricula. An appraisal of the further mathematics curricula (in terms of objectives, content

and implementation). Mathematics laboratory and library. Laboratory/practical approach to selected concepts. Teaching of special (selected) topics.

**MAT 315(Statistics 11) 3R**

Nature and scope of statistics. Populations samples and inductive presses. Tabular and diagrammatic representation of data. Combinatorial analysis. Discrete and continuous distribution, poison. Normal, t, F, and X2 distributions. Measure of location and dispersion. Inference about population means, proportions and variances. Estimation. Test of significance. Correlation and regression, Elementary Treatment of time series.

**MAT 316(Elementary Number Theory) 3E**

Properties of Integers: Addition, Multiplication and law of trichotomy. Ordered do-mains, well-ordering principle. Mathematical induction. Divisibility. Integral divisor. Proper divisor. Primes. Composites. Euclid's division algorithm, Greatest common divisor. Relatively prime Integers. Least common multiple. Fundamental theorem of arithmetic. Congruences: Congruences modulo n. Residues and class of residue. Complete resi-Fermat's theorem and applications. Linear Congruences and applications. Reciprocal. Wilson's theorem.

**MAT 317(Mechanics 1) 3C**

Displacement, speed velocity and acceleration of a particle. Newton's laws of Motion and applications to simple problems. Work, power, and energy. Application of the principle of conservation of energy to motion of particles and those involving elastic strings and springs. Collision of smooth spheres. Simple problems of projectiles conical pendulum. Simple Harmonic Motion. Resultant of any number of forces acting on a particle, reduction of coplanar foresacting on a rigid body to a force, Equilibrium of coplanar forces, parallel forces, couples. Laws of friction. Applications of the principle of moments. Motions of inertial of simple bodies.

**MAT 321(Mechanics II) 3E**

Vectors in Euclidean spaces; Vector products; calculus. General Kinematics Momen-tum; Angular momentum; Energy and conservation laws; Dynamics of particle andof a rigid body.

**MAT 322 (Numerical Methods) 3E**

Approximations; significant figures, Errors; Truncation. Round-off, Global; Recursive computation;(e.g. Homer's method, and Synthetic division for polynomials. Polynomials and their zero (mainly for degree 4 or less) Bisection Rule; Newton-polation Integration; Trapezium and Simpson's Rules. Systems of Linear equation, Gauss elimination, Gauss-Oodan method, Jacob iterative method Gauss-field iterative method.

**MAT 323(Linear Algebra 11)3C**

Vector spaces: Definition and examples of vector spaces. Subspaces. Bases and Dimension. Rank of a matrix. Linear transformation: Definition and examples of linear transformation

**MAT 324 Differential Equations II 3R**

Treatment of firm ultaneous Differential Equations. Series solution of simultaneous Differential Equation. Linear Partial Differential Equations of 1st order and 2nd order. Application of Differentiate equations to physical and social sciences.

**MAT 325 Statistics 3E**

Discrete and continuous probability distributions mathematical expectations and moments of random variables. Moment generating functions. The binomial, poison, geometric, hypergeometric distributions. The normal, uniform, gamma and beta distributions. Functions of a univariate random variable. Bivariate distributions.

**MAT 411 (General Topology) 3E**

Topological spaces, neighbourhoods and neighbouhood systems, subspaces, induced topology. Bases, sub-bases, continuity. Matric and normed spaces. First countable, separable spaces. Hausdorff, regular, normal spaces.T1, T2, T3, T4 spaces. Com-pactness. Product spaces. Connectedness.

**MAT 412 Statistics III (3R)**

(Functional Analysis I)

Metric spaces: Open and closed sets, compact sets, connected sets, limits, sequences, complete metric spaces. Functions, on Metric spaces; Continuity, homeomorphism, isometry. Normal linear spaces: Definition and examples, convex sets. Norms, HolderMinkowski inequalities. Riesz-Risher's theorem, functional, linear operator.

**MAT 413(Advanced Algebra) 3E**

Sylow theorems: P-Groups. Direct products and groups of low order. Solvable groups, composition series. Jordan-Holder theorem: Finitely generated Abelian groups. Exten-sion fields. Transcedence of e. Roots of Polynomials. Galois Theory.

**MAT 414(Complex Analysis 11) 3E**

Mermorphic functions. Zeros and poles.

Argument principle. Rouche's. Sumation of series.

Mittag-Leffler's theorem. Maximum principle

Principle of analytic continuation. Schwaftx-Christoffel transformation.Boundary value problems.

**MAT 415 (Quantum Mechanics) 3E**

Classical Dynamics in Hamiltionian form and its application to atomic problems.

The Bohr theory. The idea of Heisenberg and Schrodinger.

Dynamics variables as operators and the state of a system. Examples of energy eign functions, the representation of states in function space.

**MAT 416 (Fluid Dynamics) 3E**

Development and scope of fluid mechanics

Viscosity, stress, surface tension, fluid statics, material derivative, two-dimensional flow, circulation, Euler’s equation, Bemouli equation, Navier-strokes equation, viscous flow, Blasius theorem. Milne-Ahompson circle theorem doublet

**MAT 417(Numerical Analysis) 3E**

Numerical solution of ordinary differential equation.

Direct and iterative methods for solution of linear systems. Numerical solution of part differential equations-Parabolic elliptic hyperbolic systems. Solution of algebraic aigenvalue problems.

**MAT 418 (Theory of Games) 3E**

Two person zero-sum and their geometric interpretations. Linear programming methods. The minima and maximum theories of n-person games and their applications.

**MAT 419 (Stochastic Processes) 3E**

Introduction to stochastic processes. Random walk. Markov chains. Markov processes. The birth death and immigration processes Queues. Walking time and servicing problems. Ronogoro equations. Purely discontinuous. The Wiener process.

**MAT 421 (Algebraic Topology) 3E**

Paths, path connectedness Honotopy theory.

Fundamental group. Covering spaces. Homology theory of spaces.

**MAT 422 (Functional Analysis II) 3E**

Bonach spaces and Hilbeit spaces. Boundeg lir functions and operators on Bonach spaces. Introduction to topological vector spaces. Instruction to Bonach algebra and the Gelfrand theory.

**MAT 423 (Lebesque Measure and Integration) 3R**

Measurable and non-measurable sets.

Measurable functions. Lebesque integral.

Integration of non-negative function. Lebesque monotonic convergence theorem.

Fatou's Lamna. Dominated convergence.

Bepo's Lemma. Bounded convergence.

**MAT 424 Commutative Algebra 3E**

Rings and ring homonorphisms. Ideals Quotient rings. Zero divisors. Nilpotent elements. Units. Prime ideals and maximal ideals Nilradical and Jacobson radical. Operations on Ideals. Extension and contraction. Modules and Modules homomorphism, sub-modules and quotient module. Operations on sub-modules. Direct sum and product. Finitely generated modules. Exact sequences. Tensor product of molecules. Restriction and extension of scalars. Exactness proper-ties of the tensor product Algebras. Tensor product of algebras. Rings of fractions, primary Decomposition. Integral Dependence. Neotherian and Artinian rings.

**MAT 425 (Partial Differential Equations) 3R**

Theory and solution of first order Equations; second-order Linear Equations; classifications; characteristics canonical forms, Cauchy problem. Elipstic equation; Laplace’s and Poison's equations, Fundamental solution, Green's function, poison's formula. Properties of harmonic functions. Hyperbolic equations; the wave equations. Retarded potential; Transmission line Equations. Reiemann method, parabolic equations; diffusion equation; singularity function, Boundary and initial value problems.

**MAT 426 (Elasticity) 3R**

Particle gravitational field Curvilinear coordinates, intervals. Covenant differentiation. Christoffel symbol and metric tensor. The constant gravitational field. Rotation.

**MAT 427 (Design of Experiment) 3E**

Basic principles of experimentation

Randomization, Replication and control

Uniform trails completely randomized block and Latin square designs.

Missing plot techniques. Factorial designs.

**MAT 428 (Operations Research) 3R**

Nature of Business Modelling. Techniques and Models; Decision and Models; Fore-casting; Investment appraisals Inventory control: Linear Programming; Network Analysis. Quesinu thoroy; Replacement Analysis; Simulation; Phases of operation Research Study. Classification of Operation Research, Mooel Linear, Dynamic and Integer Programming. Decision theory Inventory models, critical path. Analysis and project controls.

**MAT 429 (Time Series Analysis) 3E**

Elementary Treatment of Time Series. Stationery process, Ergodicity, Auto-correlation function. Spectral density function and its representation. Linear filters. Elements of prediction theory, estimation of correlation function and spectral density. Applications.

**INSTRUCTIONAL GRADING METHODS**

We are online University that provides a top-notch academic and professional programmes which will create value for your future in the world.

**Evaluation**

All students would be evaluated at the end of each semester based on the following:

* **Tutor*Marked Assignments***

The lecturer marked assignments (LMAs) are multiple choice questions that will be administered online during every semester. The LMAs carry 30%.

* **End of Semester Examination**

The school conducts the end of each Semester examination. The examination overall scores carry 70%.

**Master’s Degree (MEd) in Mathematics**

The master’s degree programme is designed to carry further research on the knowledge and training the students have received on the first degree. The department of the university will prescribe the courses you will offer throughout your time of degree.

The courses will be selected from the courses in the first degree for further studies before the Master’s dissertation (Project). The topic of the project will be discussed with your assigned supervisor (s).

**Minimum Tenure of the Programme**

The tenure for the Master’s degree programme for Mathematics is minimum of four (3) Semesters full time and 4 semester for part-time programme.

**Evaluation of the MEd Candidates**

The minimum units for graduation should be 30 including the dissertation/thesis. The average mark for the programme is based on grades scored in all the courses taken including project. Examination grades in each course are recorded as percentage marks, and are interpreted as follows:

**Doctor of Philosophy (PhD) in Mathematics**

The PhD programme shall be normally not less than 4 semesters (2 years) from the first date of registration. Also, for this programme, a period of study originally approved for the 3-semester Masters programme may be accepted as satisfying a specific part of the period of study for the PhD. In no circumstances, however, may a period exceeding 12 calendar months be waived for a candidates. A programme is a combination of course work research.

**Requirements for PhD**

Candidates for admission to the programme shall possess the Following:

1. Those initially registered for the MSc or MPhil/PhD conversion programme of the department and who have obtained a total weighted average mark of at least 60% in the course examinations and project at our university or any recognized university.
2. Candidates admitted to the programme will be required to take certain courses at the 700/800 levels as the case may be in their areas of interest.
3. Students are required to refer their research proposal to an examination panel as recommended by the department and give department seminars on their PhD research work.

Each PhD student shall present at least two seminars during the course of his/her programme of study. The first seminar shall be presented at the research proposal stage and the second shortly before the registration of the title of thesis.