

MAT 111 ALGEBRA**2 CREDITS C**

At the end of course the student should be able to discuss and solve simple problems in algebra.

- Real number system
- Integers, rational and irrational numbers
- Set theory, intersection, complement of set , venn diagram, algebra of sets
- Theory of indices
- Theory of logarithms
- Surds
- Linear inequalities
- Partial fractions
- Theory of quadratic equation
- Permutations and combinations
- Binomial theorem
- Remainder and factor theorems
- Arithmetic progression
- Geometric Progression

MAT 112 TRIGONOMETRY**1 CREDIT C**

At the end course the student should be able to:

- a. Discuss with confidence the basic concepts and definition in trigonometry
- b. Solve simple problems using the concepts

Topics:

- Angle and its measurements
- Basic trigonometric functions and equations
- Trigonometric ratios in each of the 4 quadrants. Application to bearing , angle of elevation, and depression
- Graphs of trigonometric functions and their applications
- Inverse trigonometric functions
- Half angle formulae
- Addition of factor formulae
- Solution of triangles

At the end course the student should be able to:

- a. Discuss and narrate the historical development of mathematics as a discipline
- b. Identity the early contributors to the development of mathematics

Topics:

- Pre-history Mathematics
- Development of Mathematics in the ancient times
- Contributions of Babylonians, Greeks, Egyptians, Romans, Hindus, Arabs and Chinese.
- Prominent ancient Mathematicians, and their contributions (Archimedes, Pythaoras, euclid, Apollonius , etc)
- Development of mathematics in the middle Age and prominent Mathematicians of the period
- The Renaissance and Mathematics (16th to 20th centuries) and prominent Mathematicians and their contributions (Napier, fermat, euler , Riemann, Lebesque, Lagrange , Hilbert, bannach , cauchy)
- The use of mathematics in everyday life including its place in natural and applied science
- History of African and Nigerian mathematics

At the end of course the student should be able to:

- a. Define the meaning of statistics
- b. Discuss the importance of statistics
- c. Form frequency distribution table
- d. Calculate measures of lacion, partiton and dispersion
- e. Explain the meaning of correlation and regression
- f. Define sample space and sample
- g. Draw normal distribution curve and skewness
- h. Carry out test of hypothesis and significance on sample data

Topics

- Frequency distribution
- Measures of location
- Measure of dispersion
- Correlation and Regression
- Sample space and Sample point
- Data Representations in statistics
- Normal distribution curves
- Skewness
- Standardized Normal Curve
- T-scores and Z-scores
- Test of hypothesis and significance

MAT 121 DIFFERENTIAL CALCULUS

1 CREDIT C

At the end of course the student should be able to

- a. Differentiate some give function
- b. Apply differentiation in solving physical problems

Topic

- Functions
- Limit of a function at a point
- Continuity of a function at a point
- Gradient of a function
- The differential co-efficient as a gradient of a function at a point
- Differential –product and quotient
- The chain rule and the function of a function
- Differentiations of logarithmic functions
- Trigonometric functions, exponential functions and hyperbolic functions
- Implicit differentiation
- Application : maximal, minimal, velocity, acceleration and rate of change

MAT 122 CO-ORDINATE GEOMETRY

2 CREDITS C

At the end of the course the student should be able to:

- a. Obtain the equation of a straight line and circle
- b. Write the equation of parabola, ellipse and hyperbola in Cartesian polar and parameter coordinator.
- c. Change Cartesian coordinates to polar & vice versa
- d. Apply the knowledge of coordinate geometry in solving real life problem

Topics

- Basic geometry piont ‘ line segment , angle , curve.
- Straight lines and circles
- Parabola , ellipse and Hyperbola in Cartesian , parametric and polar co-ordinates
- Tangents and Normal to the circle , parabola, eclipse and hyperbola (the use of differentiation is acceptable

MAT 123 MATHEMATICS METHODOLOGY

1 CREDIT C

At the end course the student should be able to:

- a. Learn the most current method of teaching mathematics
- b. Write lesson plan & lesson notes in mathematics

Topics

- History of Mathematics teaching in Nigeria and the philosophy of current Nigerian Mathematics curricula
- Teaching and learning mathematics , including works of Brune., Gagne, Piaget and Dienes
- Teaching of concepts, principles, skills and proofs: strategies, nature, definitions and types.
- Inductive , deductive , analytic and synthetic approaches in Mathematics teaching
- Work tools (scheme of work, lesson plan, lesson presentation and assesment)
- Item construction and development of marking scheme
- Diagnosis and remediation of difficulty concepts and topics in teaching and learning of upper basic mathematics curriculum
- Problems and prospects of Mathematics education in Nigeria

MAT 124 MATHEMATICS LABORATORY PRACTICAL

1 CREDIT C

At the end course the student should be able to:

- a. Design and construct improvised mathematical teaching aids.
- b. Construct triangle, quadrilaterals loci etc. using pair of compass and rulers.

Topics

- Construction, designs and improvisation of some basic mathematical teaching aids in relation to primary, junior secondary school and senior secondary school courses . (using cardboard sheets, clay wood, wires , etc)
- Geometrical construt: construction of triangles, quadrilaterals, bisection of lines , angles and construction of locus.
 - Definition of Mathematics laboratory
 - Roles of laboratory in mathematics teachings
 - Management of Mathematics laboratory plus other topics in the outline
 - Excursion

MAT 125 INTRODUCTIONS TO COMPUTER STUDIES 1 CREDIT E

At the end of course the student should be able to:

- a. State fundamental operations in mathematics structures and their uses in computer studies
- b. Define with example binary logic, compoud statement and binary operations
- c. Discuss historical development of the computer studies
- d. Differentiate between software and hard ware

- e. Write simple programme using basic,
- f. Apply the application to data processing plus operating systems eg. Dos, windows

Topics

- Historical development of the computer
- Essential components of the computer and their functions
- Number presentation in a computer
- Logic – binary logic, compound statement –logic relations, methods of proofs binary operations.
- Number bases other than 10
- Data structure and their uses in computer
- Computer software and types of software, Basic Programming
- Illustration and the application of simple techniques to Data processing plus
- Operating systems: dos , windows etc. (emphasis on practical)

MAT 211 INTEGRAL CALCULUS

1 CREDITS C

At the end course, the student should be able to:

- a. See the link between differentiation and integration
- b. See the link between integration and area
- c. Identify and use of different integration method
- d. Use the different methods of integration in real engineering problems
- e. Appreciation the importance of integration in engineering and science generally

Topics

- Integration as a reverse process of differentiation
- Integration as area under the curve
- Integration of algebraic functions using different methods, like partial fractions, substitution, etc.
- Integration of non-algebraic functions eg. logarithmic functions, exponential unctions , trigonometric functions , etc.
- Special methods of integrations , substitution and transformation, the reduction formula and other types of systematic integration
- Integration by parts, approximate integration by Trapezoidal rule and simpson’s rule
- Application of integration in determining volumes of solid ‘ revolution and solution to other problems

MAT 212 PROBLEM – SOLVING (JSS & SSS)

1 CREDIT C

(Textbooks on these levels should be provided at least two students to a copy of each)

- a. Identify what is a problem and decide on the most appropriate approach to the solving problem
- b. Identify as many methods as possible to the solving of identified problem eg discovery , expository
Child centre approach

- c. See that life itself is problem, and always have solutions if given the right approach. Appreciate the different techniques so identified in solving day to day problems.

Topics

- Definitions of problem, problem solving
- Basic elements of a mathematics problem
- Common errors in Mathematics
- Discovery and expository approaches to problem solving techniques
- Functions of questions in the Mathematics class
- Characteristic of a good problem solver
- Polya's problem solving heuristics and application to solving topics in J.S.S . & S.S.S. Mathematics
- Problem solving of selected difficult topics in Mathematics and further
- Mathematics e.g solid figures, great circles ,application of the cosine rule to triangles (acute and obtuse angle) etc.

MAT 213 NUMBER THEORY

1 CREDIT C

At the end of course the student should be able to:

- a. Exhibit the proper concept of number system by correctly showing the direction and magnitude of numbers.
- b. Play and manipulate different ideas as to the use of numbers, eg: ordering of numbers, mathematical inductions, basic facts on numbers(theorem), congruence etc.
- c. See and appreciate the use of numbers in the real-life situations

Topics

- Process of counting, Poincaré's Axioms using ordered pairs
- Fundamental operations in Mathematical structures
- Group-Group properties
- Further properties of Integers
- Well ordering principle
- Mathematical Induction
- Laws of trichotomy
- Divisibility (Basic definitions, divisions , primes etc)
- Basic theorems on gcd
- (proofs may be required)
- Relatively prime integers (unique factorization)
- The fundamental theorem of arithmetic (proof may be required)
- Required
- Euler function and number (proof not required)

MAT 214 PROBABILITY THEORY

1 CREDIT C

At the end of course the students should be able to

- a. Learn the concepts of probability
- b. Solve problems involving addition law, multiplication law of probabilities
- c. Formulate hypotheses and arrive at the right decision
- d. Apply the knowledge of probability in another relevant situation

Topics

- Concept of probability
- Types of probability
- The concept of expectation
- Mutually exclusive and non-mutually exclusive events
- Addition law of probability
- Independent events and dependent events
- Multiplication law of probability
- Conditional probability
- Discrete probabilities
- Continuous probabilities
- The binomial Poisson and normal distribution with various properties.

MAT 221 DYNAMICS

1 CREDIT C

At the end of the course, the student should be able to:

- a. Explain the concept of displacement, speed, velocity and acceleration in Cartesian and polar co-ordinate
- b. Discuss relative velocity motion of particles in straight lines
- c. State the principle of conservation of energy.
- d. State and discuss type of collision
- e. Discuss the concept of projectile, momentum vertical motion under gravity
- f. Solve problem on dynamics

Topics

- Displacement, speed, velocity and acceleration in Cartesian and Polar co-ordinates
- Velocity and acceleration along the tangent and normal to it
- Relative velocity, motion of particles in straight lines
- Vertical motion under gravity (laws of motion)
- Projectiles: Time of flight, range on a horizontal plane, greatest height reached, the path of a projectile as parabola
- The momentum principles
- Impact of two small spheres (direct and oblique)

- The principle of conservation of energy

MAT 222 NUMBER THEORY

1 CREDITS C

At the end course, the student should be able

- Represent vectors in 2-3 dimensions
- Solve problem in vector algebra
- Apply the knowledge of vector analysis in solving real life problems.

Topics

- Representation of vectors in 1-3 dimensions
- Equality ,of vectors , position vectors (explain using the model of space co-ordinate)
- Triangular , parallelogram and polygon laws of vector ,addition
- Resultant of vectors
- Associative law of vectors
- Negative and unit vectors
- Magnitude or length of a vector
- Commutative and distribution law of vectors, Scalar or dot product of vectors
- The vector or cross product of two vectors
- The cosine of angles between two vectors
- Direction cosines
- Relations between dot product and component of work done in force field
- Triple product of vectors
- Plane and space curves and their vector equations
- Vector differentiation
- The del (or vector operator notation)
- The divergence of a curve vector and the divergence theorem
- Frener-serret formulae for solution of problems''

MAT 223 REAL ANALYSIS 1

1 CREDIT C

At the end Course, the student should be able to:

- Solve abstract problems using mathematical skills
- Use correctly the methods of proofs in mathematics.

Topics

- Basic properties of real number system including boundedness and completeness
- Concept of neighborhood
- Open and close sets
- Basic theorem on open and closed sets

- De Morgan laws
- Function and functional notation
- Rigorous treatment of limits and continuity
- L' hospital rule (proof may be required)
- Consequence of differentiation
- Rolle's theorem
- Mean value theorem and Taylor's theorem (proof may be required)
- Successive differentiation
- Leibnitz's formula for nth derivative (proof not required)
- Functions of several variables
- Partial differentiation
- Lagrange's multipliers

MAT 224 JUNIOR SECONDARY SCHOOL CONTENT 1 CREDIT C

At the end of the course the students should be able to:

- a. Learn by heart the sequential arrangements of all the topics in junior secondary school mathematics
- b. Solve difficult problems in junior secondary school mathematics

Topics

- Fractions decimals and approximation:-harder word problems involving fractions decimals and approximations.
- Expansion & factorization
- Simultaneous linear equations:- elimination , substitutions , graphical methods word problems leading to simultaneous equations.
- Quadratic equation by factorization only, word problems involving quadratic equations.
- Algebraic fractions & algebraic equations, word problems involving algebraic equations
- Pythagoras theorem and its applications
- Angles of elevation and depression
- Areas and perimeters of plane shapes:- problems involving areas and perimeters
- Properties of solid shapes :- cupes , cuboid, cylinder , spheres , pyramid , cones etc and surface areas and volumes of solid shapes
- Variations:- Direct inverse, joint and partial variation including word problems
- Trigonometric ratios and their application
- Commercial arithmetic (profit and loss, discount hire purchase, commission)
Number basis.
- Scale drawing
- Areas and volumes of similar shapes

The reason for this course is to prepare students to carry out research works in Mathematics education without much difficulty

1. Research study

- a. Background of the study
- b. Statement of problem
- c. Purpose of the study
- d. Scope of the study
- e. Area of the study
- f. Significance of the study
- g. Research questions

2. Literature Review

The relevance of the review to the background of study must be clearly showed to the students.

3. Method of data organisation

- a. Techniques of getting the sample from sample population such as
 - i) Simple ballot system
 - ii) Use of table of random numbers and any other
 - iii) Slating the population and the sample
- b. Instrument for data collection
- c. Validation of instrument
- d. Analysis of data- Frequency table, percentage , t-test and z-test statistic
- e. Correlation coefficient
- f. Results and interpretation
- g. Recommendation

MAT 321 STATICS**1CREDITS**

At the end of course the student should be able to:

- a. Explain with confidence the concept of statics
- b. Solve simple problem on statics
- c. Justify the relevant of statics
- d. Resolution of forces and turning points practically

Topics

- Force , definition of force and types of force
- Resolution of forces acting at a point
- Moments, definition of moment and types
- Equilibrium conditions of moments
- Equilibrium, definition and types.
- General conditions of equilibrium

- Friction: laws of friction and resistance , angle of friction, the least force problem involving sliding only
- Coplanar forces (centroids)
- Centre of gravity: Centre of mass, simple forms, general formula for centre of gravity
- Compound bodies, centre of gravity by integration

MAT 322 LINEAR ALGEBRA

1 CREDITS

At the end of course the student should be able to

- Discuss with confidence the concept and the meaning of linear algebra such as vector space over the real field, sub-space , linear independence , basis and dimension, linear transformations, eigenvalues etc
- Solve simple problem on the linear algebra
- Apply the knowledge of the concept to other area

Topics

- Matrices : definition, equality of matrices, addition , scalar multiplication , multiplication of matrices , inverse matrices , adjoint transpose, row equivalence and elementary row operations.
- Determinants:- up to 2x2 matrices . application of matrices to solutions of linear equations
- Determinants
- Vector space over the real field, sub-space, linear independence , basis and dimension
- Linear transformations and their representational matrices , range , null space, rank, singular and non-singular and non-singular transformation and matrices.
- System of linear equations, change of basis , equivalence and similarities
- Minimum and characteristic polynomials of a linear transformation (matrix)

MAT 323 REAL ANALYSIS II

1 CREDIT E

At the end of course , the student should be able to :

- Discuss the meaning of anti-derivatives, Riemann integral and its properties
- Define and solve problem on multiple integrations, series and sequence
- Approve the relevance of real analysis in everyday life and for further studies

- Properties of integrals and basic theorems (proof of the fundamental theorems of calculus may be required)
- Series and sequences
- Proof of boundedness ; comparison , ratio and root test may be required
- Absolute and conditional convergence
- Power series

MAT 324 ABSTRACT ALGEBRA**1 CREDITS C****ALGEBRAIC STRUCTURES**

At the end of course, the student should be able to :

- Explain the meaning of algebraic structure
- Define the following : group , semi group , monoid, group and subgroup
- State lagrange theorem
- Explain the concepts of cycli group, ring , integrl domain , field
- Solve problems on polynomials , HCF, LCM and factorization

Topics

- Grouped , semi group , monoid and group , sugroup
- Lagrange theorem , cyclic group , ring, integral domain , division , ring and field
- Polynomials: H.C.F and L.C.M of polynomials
- Factorization

MAT 325 DIFERENTIAL EQUATIONS**1 CREDIT C**

At the end of the course students should be able to:

- Discuss the meaning of first-order differential equation
- State the existence and uniqueness of solution
- Apply different methods of solving differential equations
- State and solve second order differential equation
- Apply the importance of differential equations in science and technology
- Formation of differential equation using physical and chemical situation

Topics

- First – order differential equations
- Existence and Uniqueness of solution
- Example to be limited to equation of the types
 $dy/dx = f(x)$, $dy/dx = f(y)$
- Use of boundary separation restricted only to easy integral
- Homogeneous Equations
- Exact equations and integrating factor for non-exact equations
- Solution of 2nd – order differential equation. Example to be restricted to the equations of the type
(a) $d^2x/dx^2 = f(x)$ (a) $d^2y/dx^2 = f(x)$

Equations with constant co-efficient and Cauchy-Euler types should be treated formation of equations from physical situations.