DEPARTMENT OF MATHEMATICS SCIENCE

NCE I (FIRST SEMESTER)

MAT 111 (ALGEBRA) 2 Credits (Compulsory)

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

Course Outline:

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 equations, Permutations and Combinations, Binomial Theorem, Mathematical Induction, Remainder and Factor Theorems, Arithmetic Progression, Geometric Progression.

References:

MAT 112 (TRIGONOMETRY) 2 Credits (Compulsory)

At the end of the course the student should be able to: (i) Discuss with confidence the basic concepts and definition in trigonometry. (ii) Solve simple problems using the concepts.

Course Outline:

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

References:

1. Engineering Mathematics Straud, K.A.
2. New General Maths SSS1-3, Kalejaye *et al.*
3. Pure Mathematics by Bunday Mulholland

MAT 113 (HISTORY OF MATHEMATICS) 1 Credit (Compulsory)

At the end of the course the student should be able to: (i) Discuss and narrate historical development of Mathematics as a discipline (ii) identify the early contributors to the development of Mathematics.

Course Outline:

Pre-history mathematics, Development of Mathematics in the Ancient time, Contributions of Babylonians, Greeks, Egyptians, Romans, Hindus, Arabs and Chinese. Prominent Ancient Mathematicians and their contributions (Archimedes, Pythagoras, Euclid, Appolonius, e.t.c.) Development of Mathematics in the Middle Ages and Prominent Mathematicians of the period. The Renaissance and Mathematics (16^{th} to 20^{th} 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.

References:

1. The History of Mathematics, by Florian Carolyn 2010

MAT 114 (COMPLEX NUMBERS) 1 Credit (Compulsory)

At the end of the course the student should be able to: (i) Explain the concepts of complex numbers. (ii) Discuss the algebra of complex numbers. (iii) Represent complex numbers in Argand diagrams. (iv) State De-Moivre's Theorem (v) Solve problems on complex numbers. (vi) Appove the important of complex number in science and Technology.

Course Outline:

Complex Numbers, Algebra of Complex numbers, Argand Diagram, De Moivre's theorem, n^{th} root of Unity.

References:

MAT 115 (STATISTICS) 2 Credits (Compulsory

At the end of the course the student should be able to: (i) Define the meaning of statistics (ii) Discuss the importance of statistics (iii) Form frequency distribution table (iv) Calculate measure of location, partition and dispersion (v) Explain the meaning of correlation and regression (vi) Define sample space and sample point (vii) State and draw normal distribution curve and skewness (viii) Cary out test of hypothesis and significance on sample data.

Course Outline:

Frequency distribution, Measures of location. Measures of dispersion. Correlation and Regression. Sample and Space, Sample point. Data Representations in statistics. Normal Distribution Curves, Skewness, Standardized Normal Curve. t- scores and Z-scores. Test of Hypothesis and significance.

References:

1. Statistics by Schaum Series.

NCE I (SECOND SEMESTER)

MAT121 (DIFFERENTIAL CALCULUS) 2 Credits (Compulsory)

At the end of the course the student should be able to: (i) Differentiate some given functions (ii) apply the differentiation in solving some physical problems.

Course Outline:

Functions, Limit 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. Differentiations of logarithmic functions, Trigonometric functions, exponential functions and hyperbolic functions, Implicit differentiation. **Applications:** maximal, minimal, velocity, acceleration and rate of change.

References:

1. Engineering Mathematics Straud, K.A.
2. New General Maths SSS1-3, Kalejaye *et al.*
3. Pure Mathematics by Bunday Mulholland

MAT 122 (CO-ORDINATE GEOMETRY) 2 Credits (Compulsory)

At the end of the course the student should be able to: (i) Obtain the equations of straight line and circle (ii) Write the equation of parabola, ellipse and hyperbola in Cartesian, polar and parameter co-ordinate. (iii) Change Cartesian coordinate to polar co-ordinates and vice-versa (iv) Apply the knowledge of coordinate geometry in solving real life problems.

Course Outline:

Basic geometry: Point, line segment, angle and 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).

References:

1. Engineering Mathematics Straud, K.A.
2. New General Maths SSS1-3, Kalejaye *et al.*
3. Pure Mathematics by Bunday Mulholland
4. Coordinate Geometry by Balogun F. O. and Lawal M. O.

MAT 123 MATHEMATICS METHODOLOGY 2 Credit Compulsory

At the end of the course the student should be able to: (i) learn the most current methods of teaching Mathematics (ii) Write lesson plan and lesson notes in Mathematics.

Course Outline:

History of Mathematics teaching in Nigeria and the philosophy of current Nigerian Mathematics curricula. Teaching and learning Mathematics, including works of Bruner, 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. Content analysis of upper basic education (JSS 1-3) curriculum. Work tools (scheme of work, Lesson plan, lesson presentation and Assessment). Item construction and development of marking scheme. Diagnosis and remediation of difficult concept and topics in teaching and learning of upper basic Mathematics curriculum. Problems and prospects of Mathematics education in Nigeria.

References:

MAT 124 (MATHEMATICS LABORATORY PRACTICALS) 1 Credit (Compulsory)

At the end of the course the student should be able to: (i) Construct, design and improvisation of some basic Mathematical teaching aids (ii) Construct triangle, quadrilaterals, loci etc. using pair of compass and rulers.

Course Outline:

Construction, design and improvisation of some basic Mathematical teaching aids in relation to primary, junior secondary school and senior secondary school courses (Using cardboard sheet, clay, wood and wire, e.t.c.). Geometrical constructions of triangles, quadrilaterals, bisection of lines, angles and construction of locus.

References:

1. New General Maths JSS1-3, Kalejaye *et al.*

MAT 125 (INTRODUCTION TO COMPUTER STUDIES) 1 Credit (Compulsory)

At the end of the course the student should be able to: (i) State fundamental operations in Mathematics structures and their uses in computer studies. (ii) Define with examples binary logic, compound statement and binary operations (iii) Discuss historical development of computer studies (iv) Differentiate between software and hardware (v) Write simple program using basic (vi) Apply the application to data processing plus operating systems e.g. DOS, window.

Course Outline:

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 a computer. Computer software and types of software, basic programming. Illustration and the application of simple techniques to data processing plus. Operating systems: Disc Operating System (DOS), Windows e.t.c.

References:

NCE II FIRST (SEMESTER)

MAT 211 (INTEGRAL CALCULUS) 2 Credits (Compulsory)

At the end of the course the student should be able to: (i) See the link between differentiation and integration (ii) See the link between integration and area (iii) Identify and use different integration methods (iv) Use the different methods of integration in real engineering problems (v) Appreciate the importance of integration in engineering and science generally.

Course Outline:

Integration as a reverse process of differentiation. Integration as area under the curve. Integration of algebraic functions using different methods like partial fractions, substitution, e.t.c. Integration of non-algebraic functions e.g. logarithmic functions, exponential functions, trigonometric functions e.t.c. 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 solids of revolution and solution to other problems.

References:

1. Engineering Mathematics Straud, K.A.
2. New General Maths SSS1-3, Kalejaye *et al.*
3. Pure Mathematics by Bunday Mulholland

MAT 212 (PROBLEM-SOLVING (JSS & SSS) 2 Credit (Compulsory)

At the end of the course the student should be able to: (i) Identify what is a problem and decide on the most appropriate approach to solving problem. (ii) Identify many methods as possible to solving identified problems e.g. discovery, expository, child cetre approach etc. (iii) See that life itself is a problem and always have solutions given the right approach. (iv) Appreciate different techniques so identified in solving day to day problems.

Course Outline:

Definitions of problems, problem solving. Basic elements of a Mathematics problem. Common errors in Mathematics. Discovery and expository approaches to problem solving techniques. Functions of questions in Mathematics class. Characteristics of a good problem solver. Polya's problem solving, heuristics and application to solving topics in JSS and SSS 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 angles) e.t.c.

References:

MAT 213 (NUMBER THEORY) 1 Credit (Compulsory)

At the end of the course the student should be able to: (i) Exhibit the proper concept of number system by correctly showing the direction and magnitude of numbers. (ii) Play and manipulate different ideas as to the use of numbers e.g. ordering of numbers, mathematical induction, basic facts on numbers in the real life situations (c) See and appreciate the use of numbers in real life situations.

Course Outline:

Process of counting, Peano's Axons using ordered pairs**.** Fundermental operations in Mathematical structures. Group - Group properties, Further properties of Integers**.** Well ordering principle**.** Mathematical induction**.** Laws of trichotomy**.** Divisibility (Basic definitions, divisions, primes god)**.** Basic theorems on god (proofs may be required)**.** Relatively prime integers (unique factorization)**.** The

fundamental theorem of arithmetic (proof of the main theorem may be required). Congruences - Basic definitions and examples. Properties of congruence (reflexive, symmetric and transitive: equivalent relation), Residue classes, Linear Congruences. Basic theorems and solutions of linear congruences (Proofs of the main theorem) may be required. Fermat's theorem and applications (The proof of Fermat's theorem may be required). Euler function and number (proof not required). Application to linear Congruences.

References:

1. S. Akinyele and S.A. Ilori, Linear and Abstract Algebra
2. A.O. Kuku, Abstract Algebra.
3. C. Santos. Elements of Number Theory.
4. F. Ayres, Theory and Problems of Abstract Algebra. Schaum outline.

MAT 214 (PROBABILITY THEORY) 2 Credits (Compulsory)

At the end of the course the student should be able to: (i) Learn the concepts of probability (ii) Solve problems involving addition law, multiplication law of probability (iii) Formulate hypotheses and arrive at the right decision (iv) Apply the knowledge of probability in other relevant situation.

Course Outline:

Concept of probability. Sampling and sampling technique. Types of probability. The concept of expectation. Mutually exclusive and non-mutually exclusive events. Addition law of probability. Independence law of probability. Independent events and dependent events. Multiplication law of probability. Conditional probability. Discrete probability. Continuous probability. Functions of a random variable. The binomial poisson and normal distribution with various properties. Permutations and combination.

References:

1. **Ugbebor O.O. (1991).** Probability distribution and elementary limit theorem. Publisher: Department of Adult Education, University of Ibadan. ISBN 978-2828-82-3.
2. **Graybill F.A. and Boes D.C. (1974).** Introduction to theory of statistics. Publisher: McGrawHill, Inc. ISBN 0-07-042864-6.
3. **Vijay K.R., Md A.K. and Ehsanes S (2001).** An introduction to probability and statistics. Publisher: John Wiley and sons, Inc. Hoboken, New Jersey. ISBN 978-0-471-34846-7.
4. **Robert B. and Magdalena N. (2008).** Probability and statistical inference. Publisher: John Wiley and sons, Inc. Hoboken, New Jersey. ISBN 978-0-471-69693-3.
5. **Murray R.S (1978).** Schaum outline of theory and problems of probability and statistics. Publisher: McGrawHill Companies, Inc. United States of America.

NCE II (SECOND SEMESTER)

MAT 221- (DYNAMICS) 2 Credits (Compulsory)

At the end of the course the student should be able to: (i) Explain the concept of displacement, speed, velocity and acceleration in Cartesian, and polar coordinates (ii) Discuss relative velocity, motion of a particle in straight lines (iii) State the principle of conservation of energy (iv) State and discuss the

types of collision (v) Discuss the concept of projectile, momentum, vertical motion under gravity (vi) Solve problems on dynamics

Course Outline:

Displacement, Speed, Velocity, and acceleration in Cartesian and Polar coordinates**.** 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)**.** Projectile: Time of flight, range on a horizontal plane, greatest height reached, the part of a projectile as parabola. The momentum equation and derivation of the impulse**.** Angular momentum principles. Impact of two small spheres (direct and oblique)**.** The principle of conservation of energy.

References:

1. **Nelson E.W., Charles B. and Mclean, W.G. (1962).** Schaum's outline of theory and problems in Engineering Mechanics (Statics and Dynamics). Publisher: Schaum Publishing company. ISBN 0-07-046193-7.
2. **David M. (2008).** Introduction to classical Mechanics. Publisher: Cambridge University Press, Cambridge, New York, USA. ISBN 978-0-521-76223.
3. **Edward A.D. (1982).** Classical Mechanics, Vol. 1. Publisher: John Wiley and sons, Inc. USA ISBN 0-471-09144-8.
4. **Edward A.D. (1982).** Classical Mechanics, Vol. . Publisher: John Wiley and sons, Inc. USA ISBN 0-471-09145-6.
5. **Gregory R.D. (2006).** Classical Mechanics. Publisher: Cambridge University Press, Cambridge, New York, USA.
6. **Gerd B. (2005).** Classical Mechanics and Non linear Dynamics. Publisher: Springer Science + Business Media Inc., New York USA. ISBN-13: 978-0387-01674-0.
7. **Godman A. and Talbert J.F. (2018).** Additional Mathematics : Pure and Applied. Publisher: Study BIUe Inc. A Chegg Servise. www.studyblue.com. ISBN 0582265118.

MAT 222 (VECTOR ANALYSIS) 2 Credits (Compulsory)

At the end of the course the student should be able to: (i) Represent vectors in 2-3 dimensions (ii) Solve problems in vector algebra (iii) Apply the knowledge of vector analysis in solving real life problems.

Course Outline:

Representation of vectors in 1-3 dimension. Equality of vectors, position vectors (explain using the model of space coordinate). 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 distributive laws of vectors, scalar or dot product of vectors. The vector or cross product of two vectors. The cosine of angles between two vectors. Direction of cosines. Relations between dot product and component of work done in a force field. Triple product of vectors. Plane and space curves and their vector equations. Vector differentiation. The grad notation. The del (or vector operation notation) . The divergence of a curve vector and the divergence theorem. Frenet-Serret formulae for solution of problems.

References:

MAT 223 (REAL ANALYSIS I) 2 Credits (Compulsory)

At the end of the course the student should be able to: (i) Solve abstract problem through the use of mathematical skills (ii) Use correctly the method of proofs in Mathematics.

Course Outline:

Basic properties of real number system including boundedness and completeness. Concept of neighbourhood. Open and close sets. Basic theorems on open and closed sets. De Morgan laws. Function and functional notation. Rigorous treatment of limits and continuity. L'Hopital's rule (proof may be required). Consequences of differentiation, Rolle's theorem, Mean value theorem and Taylor's theorem (proofs may be required). Successive differentiation. Leibniz's formula for nth derivative (proof not required). Functions of several variables. Partial differentiation. Lagrange's multipliers.

References:

MAT 224 (JUNIOR SECONDARY SCHOOL CONTENTS) 1 Credit (Compulsory)

At the end of the course the student should be able to: (I) Learn by heart the sequential arrangements of all the topics in junior secondary school Mathematics (ii) Solve difficult problems in junior secondary school Mathematics.

Course Outline:

Fractions, Decimal, Approximation. Harder word problems involving fractions, decimals and approximations. Expansion and Factorizations. Simultaneous linear equations: elimination, substitutions, graphical methods, word problems leading to simultaneous equations. Quadratic equations by factorization only. Word problems involving quadratic equations. Algebraic fraction and Algebraic equations. Word problems involving Algebraic equations. Pythagoras theorems and applications. Angles of Elevation and Depression. Properties of solid shapes:- cubes, cuboid, cylinder, spheres, pyramid and cones. Areas and Perimeters of plane shapes:- problem involving areas and perimeters, surface areas and perimeters, surface areas and volume of solid shapes. Variations:- Direct, inverse, joint and partial variation including word problems. Trigonometric ratios and their applications. Commercial Arithmetic (profit and loss, discount, hire purchase, commission). Scale drawing.

References:

MAT 225 (RESEARCH METHODOLOGY) 1 Credit (Compulsory)

(**Note:** This course should be taken by students wishing to write their project in Mathematics Education)

Aim: The teaching of this course is aimed at preparing students to learn how 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.
2. **LITERATURE REVIEW:** The relevance of the review to the background of study must be clearly shown to the students.
3. **METHOD OF DATA ORGANIZATION:** (a) Techniques of getting the sample population such as (i) Simple ballot system (ii) Use of table of random numbers and any other (iii) Stating the population and the sample
   (b) Instrument of Data Collection
   (c) Validation of Instrument
   (d) Analysis of Data: frequency table, percentages, t-test and z-test statistics,
   (e) Correlation coefficient.
4. **Results and interpretation**
5. **Recommendation**

References:

NCE III (FIRST SEMESTER)

EDU 311
TEACHING PRACTICE

NCE III (SECOND SEMESTER)

MAT 321 (Statics) 1 Credit (Compulsory)

At the end of the course the student should be able to: (i) Explain with confidenc the concept of statics (ii) Solve simple problems on statics (iii) Justify the relivance of statics (iv) Resolution of forces and turning points practically (v) Apply the concepts in solving problems.

Course Outline:

General conditions of equilibrium. Resolution of forces acting at a point. Equilibrium conditions of moments. Coplanar forces (centroids). Centre of gravity: centre of mass, simple forms, general formula for centre of gravity. Compound bodies, centre of gravity by integration. Friction: Laws of friction and resistance, angle of friction, the least force problem involving sliding only.

References:

MAT 322 (Linear Algebra) 1 Credits (Compulsory)

At the end of the course the student should be able to: (i) 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 transformation, eagenvalues etc. (ii) Solve simple problem on linear algebra (iii) Apply the knowledge of the concept to other areas.

Course Outline:

Matrices:- definition, equality of matrices, addition, scalar multiplication, multiplication of matrices, inverse matrices, adjoint, transpose, row equivalence and elementary row operation. Determinants:- up to 2x2 matrices. Application of Matrices to solution of linear equations. Vector space over the real field, sub-space, linear independence, basis and dimension. Linear transformations and their representational matrice; range, null space, rank, singular and non-singular transformation and matrices. System of linear equation, change of basis, equivalence and similarities. Eigen values (latent roots) and given vectors (latent vectors). Minimum and characteristic polynomials of a linear transformation (matrix). Cayley – Hanmilton theorem.

References:

1. Introduction to Linear Algebra by Seymour Lipschuts

MAT 323 (REAL ANALYSIS II) 2 Credit (Elective)

At the end of the course the student should be able to: (i) Discuss the meaning of anti-derivatives, Riemann Integral and its properties (ii) Define and solve problems on multiple integrations, series and sequences (iii) Approve the relevant of real analysis in everyday life and for further studies (iv) Solve problems on real analysis.

Course Outline:

Anti-derivative (integration). Definition of Riemann integral. Properties of integrals and basic theorems (proof of the fundamental theorems of calculus may be required). Multiple integration; elementary treatment of the Fubinis theorem in the plane. Series and sequences. Proof of boundaries; comparison, ratio and root test may be required. Absolute and conditional convergence. Radius of convergence. Power series. Uniform convergence.

References:

MAT 324 (ABSTRACT ALGEBRA) 1 Credit (Elective)

At the end of the course the student should be able to: (i) Explain the meaning of algebraic structure (ii) Define the following: Group, semi group monoid, group and subgroup (iii) State Lagrange theorem (iv) Explain the concept of cyclic group, ring, integral domain, field (v) Solve problems on polynomials: HCF, LCM and factorization.

Course Outline:

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

References:

MAT 325 (DIFFERENTIAL EQUATIONS) 1 Credit (Compulsory)

At the end of the course the student should be able to: (i) Discuss the meaning of first-order differential equations (ii) State the existence and uniqueness of solution (iii) Apply different methods of solving differential equations (iv) State and solve second order differential equation (v) Approve the importance of differential equations in science and technology (vi) Formation of differential equations using physical and chemical situations.

Course Outline:

First-order differential equations. Existence and uniqueness of solution. Example to be limited to equation of the types

$$\frac{dy}{dx} = f(x) \ , \ \frac{dy}{dx} = f(y)$$

Use of boundary separation restricted only to easy integral. Homogeneous Equations.. Exact equations and integrating factor for non-exact equations. Solution of second order differential equation. Example to be restricted to the equations of the type

$$\frac{d^2y}{dx^2} = f(x), \ \frac{d^2y}{dx^2} = f(y).$$

Use of boundary separation restricted only to easy integral. Homogeneous Equations. Exact equations and integrating factor for non-exact equations. Solution of second order differential equation. Example to be restricted to equations of the type (a) $\frac{d^2y}{dx^2} = f(x)$, (b) $\frac{d^2y}{dx^2} = f(x)$.

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

References:

1. Differential Equations by Schaum Series