NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA

MATHEMATICS

FOR

NATIONAL INNOVATION DIPLOMA

CURRICULUM AND COURSE SPECIFICATION

2007

PLOT B BIDA ROAD, P. M. B. 2239, KADUNA

PROGRAMME: **NATIONAL INNOVATIVE DIPLOMA**

GOAL: This course is designed to provide trainees with sound knowledge of mathematics to enhance their knowledge of Mathematical concepts and their applications for solving professional problems.

S/N	CODE	MODULES	CONTACT HOURS
1.	MAT101	Algebra and Elementary Trigonometry	30
2.	MAT 112	Logic and Linear Algebra	30
3.	MAT 221	Trigonometry and Analytical Geometry	30
4.	MAT 232	Calculus	30
5.	MAT 241	Business Mathematics I	24
6.	MAT 252	Business Mathematics II	24
7.	MAT 261	Descriptive Geometry	30
8.	MAT 272	Number System and Boolean Algebra	45

PROGRAMME: NATIONAL INNOVATION DIPLOMA

COURSE TITLE: ALGEBRA AND ELEMENTARY TRIGONOMETRY

COURSE CODE: MAT 101

COURSE DURATION 30 HRS

COURSE UNIT: 3

YEAR: 1 **SEMESTER**: 2

COURSE UNIT 2.0

GOAL This course is intended to enable students acquire basic knowledge of Algebra and Trigonometry and apply same in solving problems in their areas of specification.

General Objectives:

On completion of this course the student will be able to:

1.0 Understand the laws of indices and their application in simplifying algebraic expressions.
2.0 Understand the theory of logarithms and surds and their applications in manipulating expressions.
3.0 Understand principles underlying the construction of charts and graphs.
4.0 Know the different methods of solving quadratic equations.
5.0 Understand permutation and combination
6.0 Understand the properties of arithmetic and geometric progressions.
7.0 Understand the binomial theorem and its application in the expansion of expressions and in approximations.
8.0 Understand the basic concepts and manipulation of vectors and their applications to the solution of engineering problems.
9.0 Understand the concepts of equations and methods of solving different types of equations and apply same to engineering problems.
10.0 Understand the definition, manipulation and application of trigonometric functions.

	Course: Algebra and Elementary Trigonometry	**Course Code: MAT 101**		**Credit Hours: 5 hours/week**		
		Contact Hours		**Theoretical: 2 hours/week**		
	Year:	**Pre-requisite:**		**Practical: 3 hours /week**		
	Theoretical Content			**Practical Content**		
	General Objective : 1.0 Understand the laws of indices and their application in simplifying algebraic expressions.					
Week	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
	1.1 Define index 1.2 Establish the laws of indices. 1.3 Solve simple problems using the laws of indices.	➢ State laws of indices ➢ Explain how to apply the laws in solving problems	➢ Text Book ➢ Chalk Board ➢ Calculator	➢ Solve simple problems using the laws of indices		
	General Objective: 2.0 Understand the theory of logarithms and surds and their applications in manipulating expressions.					
	2.1 Define logarithm. 2.2 Establish the four basic laws of logarithm. 2.3 Exemplify logarithm. 2.4 Define natural logarithm and common logarithm. 2.5 Define characteristics and mantissa. 2.6 Read the logarithmic table for given numbers. 2.7 Simply numerical expressions using log tables e.g. 18 D = 3	Define Log. State and prove laws of logarithm Explain how to apply Log. In finding solutions to non linear equations				

	$4JPC^{2}\mp M^{B}$, find D when J = 0935, e.g. 0 = 35, P = 1.6 10^{6} . C = 55, M = 0 0025, π = 3.142.					
	2.8 Apply logarithm in solving non-linear equations. e.g. = dx^{n} logy – log a + n log x y = bc^{x} – logy – hgb + xhgc Y = a+bx^{n} – Log (Y-D) = Logb) + n gx,. 2.9 Define surds 2.10 Reduce a surd into it's simplest form. 2.11 Carry out the algebra of surds.	-				
	General Objective: 3.0 Understand principles underlying the construction of charts and graphs.					
	3.1 Construct graphs of functions such as Y = ax^{n} +b,n =± 1,2… y =mx + c, y = ax^{k}, including cases of asymptotes 3.2 Apply knowledge from 3.1 in determination as laws from experimental data.	➢ Explain different types of graphs ➢ Show how to use graph in determination of experimental data	• Chalkboard • Chalkboard Ruler • Text book	• Construct table of values and draw graphs		

	General Objective: 4.0 Know the different methods of solving quadratic equations					
	4.1 Solve quadratic equations by factorization. 4.2 Solve quadratic equations by method of completing squares. 4.3 Solve quadratic equations by formula 4.4 Discriminate the roots. 4.5 Form equations whose roots are given in different methods.	Solve problems on quadratic equations using different methods Explain conditions for real, complex and coincidence roots		Use factorization or completing the square methods to solve quadratic equations.		
	General Objective: 5.0 Understand different types of permutations and combinations					
	5.1 Define permutations and combinations 5.2 Give illustrative examples of each of 2.1 above. 5.3 State and prove the fundamental principle of permutation. 5.4 Give illustrate examples of the fundamental principles of permutation. 5.5 Establish the formula $nPr = \frac{n!}{(n-r)!}$ 5.6 Prove that nPr = (n – r + 1) x nP (r – 1). 5.7 Solve problems of permutations With restrictions on some of the objects. 5.8 Solve problems of permutations in which the objects may be repeated.					

	5.9 Describe circular permutations. 5.10 Solve problems of permutation of N things not all different. 5.11 Establish the formula $^{n}C_{r} = \frac{n!}{r!(n-r)!}$ 5.12 Illustrate 2.11 above 5.13 State and prove the theorem ^{n}C (r -1) + n (r = (n + 1) Cr. 5.14 Solve problems of combinations with restrictions on some of the objects. 5.15 Solve problems of combinations of n different things taken any number at a time.					

	General Objective: 6.0 Understand the properties of arithmetic and geometric progressions.					
	6.1 Define an Arithmetic progress (A.P.). 6.2 Obtain the formula for nth term and the first n terms of an A.P. 6.3 Give examples of the above e.g. find the 20^{th} term of the series e.g. 2+4+6+…. Find also the Series of the first 20 terms. 6.4 Define a geometric progression (G.P.) 6.6 Obtain the formulae for the nth term and the first n terms of a Geometric series. 6.7 State examples of 7.5 above e.g. given the sequences 1/3, 1, 3... Find the 20^{th} term and hence the sum of the 1^{st} 20 terms. 6.8 Define Arithmetic mean (AM) and Geometric mean (G.M.) 6.9 Define convergence of series. 610 Define divergence of series.	• Define and explain terms • Solve problems • Give assignment		• Solve problems on AP and GP		

	General Objective: 7.0 Understand the binomial theorem and its applicator in the expansion of expressions and in approximations					
	7.1 Explain the method of mathematical induction 7.2 State and prove the binomial theorem for a positive integral index. 7.3 Expand expressions of the forms. $(x + y)^2$, $(x^2 - 1/x^2)^n$ n = 1, 2, 3… Applying binomial theorem. 7.4 Find the co-efficient of a particular term in the expansion of simple binomial expressions. 7.5 Find the middle term in the expansion of binomial expression. 7.6 State the binomial theorem for a rational index. 7.7 Expand and approximate expressions of the type $(1.001)^n$, $(0.998)^n$, $(1+x)^{1/2}$, $(1-x)^{1/3}$ to a stated degree of accuracy applying scalar expressions.	State and prove the Binomial theorem and use it to expand $(x \pm y)^n$ Where n = 1, 2, 3…				
	General Objective: 8.0 Understand the basic concepts and manipulations of vectors and their applications to the solution of engineering problems					

	8.1 State the definitions and representations of vectors. 8.2 Define a position vector. 8.3 Define unit vector 8.4 Explain scalar multiple of a vector 8.5 List the characteristics of parallel vectors 8.6 Identify quantities that may be classified as vector e.g. displacement velocity, acceleration, force etc. 8.7 Compute the modulus of any given vector up to 2 and 3 dimensions. 8.8 State the parallelogram law for addition and subtraction of vectors. 8.9 Apply the parallelogram law in solving problems including addition and subtraction of vectors. 8.10 Explain the concept of components of a vector and the meaning of orthogonal components. 8.11 Resolve a vector into its orthogonal components. 8.12 List characteristics of coplanar localized vectors.	• Solve problems on concept and manipulation of vectors and their application in engineering problems. • Give assignment		• Solve problems on application of vectors in engineering		

	8.13 Define the resultant or composition of coplanar vectors. 8.14 Compute the resultant of coplanar forces acting at a point using allegoristic and graphical methods. 8.15 Apply the techniques of resolution and resultant to the solution of problems involving coplanar forces. 8.16 Apply vectoral techniques in solving problems involving relative velocity. 8.17 State the scalar product of two vectors. 8.18 Compute the scalar product of given vectors. 8.19 Calculate the direction ratios of given vectors. 8.20 Define the cross product of the vector product of two vectors. 8.21 Calculate the angle between two vectors using the scalar product					

	General Objective: 9.0 Understand the concepts of equations and methods of solving different types of equations and apply same to engineering problems.					
	9.1 Explain the concept of equation, i.e. A = B where A and B are expressions. 9.2 List different types of equations: Linear, quadratic, cubic, etc. 9.3 State examples of linear simultaneous equations with two unknowns and simultaneous equations with at least one quadratic equation. 9.4 Apply algebraic and graphic methods in solving two simultaneous equations involving a linear equation and a quadratic equation. 9.5 Apply the algebraic and graphic methods in solving two simultaneous quadratic equations. 9.6 Define a determinant of n^{th} order.	• Define and explain terms. • Differentiate between expression and equations • Solve relevant problems		• Solve different types of equations		
	General Objectives: 10.0 Understand the definition, manipulation and applications of trigonometric functions.	•		•		
	10.1Define the basic trigonometric ratios, sine, cosine and tangent of an angle. 10.2 Derive the other trigonometric ratios: cosecant, secant and cotangent using the basic trigonometric ratios in 10.1 10.3 Derive identities involving	•		•		

	trigonometric ratios of the form: $\cos^2\theta + \sin^2\theta = 1,$ $\sec^2\theta = 1 + \tan^2\theta$ etc. 10.4 Derive the compound angle formulae for $\sin(A \pm B), \cos(A \pm B)$ *and* $\tan(A \pm B)$					

PROGRAMME: NATIONAL INNOVATION DIPLOMA

COURSE TITLE: LOGIC AND LINEAR ALGEBRA

COURSE CODE: MAT 112

COURSE DURATION **30 HRS**

COURSE UNIT: 3 2hrs lecture 1hr tutorial

YEAR: 1 **SEMESTER**: 1

GOAL This course is intended to enable students develop precise, logical and abstract thinking and the ability to recognize, formulate, and evaluate problems in their areas of specialization in areas such as logic and solution of linear and simple non-linear equations.

General Objectives:

On completion of this course the student will be able to:

1.0 Understand the basic rules of mathematical logic and their application to mathematical proofs.

2.0 Understand the concept of Set Theory

3.0 Understand the binomial expansion of algebraic expansions

4.0 Understand the algebraic operations of matrices and determinants as well as solve simultaneous linear equations by the methods of matrices.

	Course: Logic and Linear Algebra	**Course Code: MAT 112**		**Credit Hours: 3hours/week**
		Contact Hours 3hrs		**Theoretical: 2hours/week**
	Year: 1 semester: 2	**Pre-requisite:**		**Tutorial 1hours /week**
	Theoretical Content			**Practical Content**
	General Objective: 1.0 Understand the basic rules of mathematical logic and their application to mathematical proofs			

Week	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	1.1 Define the essential connectives, negation, conjunction, disjunction, implication and bi-implication. 1.2 Illustrate the essential connectives defined in 1.1. above. 1.3 Describe grouping and parenthesis in logic 1.4 Explain Truth Tables. 1.5 Define tautology 1.6 Give examples of types of tautology e.g. i) If P and Q are distinct sentences, which of the following are tautologies? (a) $P \rightarrow Q$ (b) $PvQ \rightarrow QVP$ (c) $(P \vee (P \wedge Q)$ ii) Let $P \rightarrow$ Jane Austen was a contemporary of Beethoven $Q \rightarrow$ Beethoven was a Contemporary of Gauss. $R \rightarrow$ Gauss was a contemporary of Napoleon' $S \rightarrow$ 'Napoleon was a contemporary of Julius Caesar'.	➢ Define various symbolic logic and give examples on how to use them. ➢ Explain Truth table with 2 or more proportion variables ➢ State rules for forming proportional connectives.	➢ Textbook ➢ Chalk Board	➢ Solve problem involving basic rules of mathematical logic		

	(Thus P, Q and R are true, and S is false). Then find the truth values of sentences:- (a) (P ∧ Q) ≡ R (b) (P Q) (c) P ∧ Q R S 1.7 Define universal quantifier and existential quantifier. 1.8 Translate sentences in to symbolic form using quantifiers. E.g. 'some freshmen are intelligent can be stated as for some x,x, is a freshman and x is intelligent' can translate in symbols as: as(ix) (Fx & 1x). 1.9 Define the scope of a quantifier. 1.10 Define 'bonne' and 'free' variables. 1.11 Define 'term' and formula'. 1.12 Give simple examples of each of 1.9 to 1.11 above 1.13 Explain the validity of formulae.		➢			

General Objective: 2.0 Understand the concept of set theory						
	2.1 Define sets, subsets, and null sets. 2.1 Define union, inter-section and complement of sets. 2.2 Draw Venn diagrams to demonstrate the concepts in 2.1 –2.3 above. 2.3 Calculate the size or number of elements in a given set.	➢ Define and explain with diagrams and examples ➢ Solve problems	➢ Chalk Board ➢ Text Book	➢ Define operations in Ste Theory and solve problems.		
	General Objective: 3.0 Compute the Binomial Expansion of Algebraic expression					

	3.1 Explain with illustrative examples – the method of mathematical induction. 3.2 State and prove binomial theorem for positive integral index. 3.3 Describe the properties of binomial expansion. 3.4 State at least seven (7) examples of 3.3 above e.g. i) A $(x^2 - \frac{1}{x})$ ii) Find the constant term in the expansion of $x\ (x + \frac{1}{x})^A$ iii) Find the co-efficient of x^V in the expansion of $(x + k)^A$ where v is a number lying between –n and n-. 3.5 State the binomial theorem for a rational number. 3.6 State the properties of binomial Coefficients. 3.7 Apply binomial expansion in approximations (simple examples only).	Explain with relevant examples. State and prove binomial theorem for positive integral index. Describe the properties of binomial expansion	**Chalkboard Textbook**			
	General Objective: 4.0 Understand the algebraic operations of matrices and determinants as well as solve simultaneous linear equations by the methods of matrices					

	4.1 Define a Matrix 4.2 Define the special matrices zero matrix, identify matrix, square matrix, triangular matrix, symmetric matrix, skew symmetric matrix. 4.3 State examples for each of the matrices in 2.2 above. 4.4 State the laws of addition and multiplication of matrices. 4.5 Illustrate the commutative, associative, distributive nature of the laws stated in 4.4 above. 4.6 Define the transpose of a matrix. 4.7 Determine a determinant for 2 by 2 and 3 by 3 matrices. 4.8 Define the minors and cofactors of a determinant. 4.9 Explain the method of evaluating determinants. 4.10 State and prove the theorem	➢ Define relevant terms ➢ Explain with examples ➢ Give assignment	➢ Chalk Board ➢ Text book	➢ Solve simple problems on matrices and determinants as well as problems on simple linear equations by methods of matrices.		

	"Two rows or two columns of a matrix are identical, then the value of its determinant is zero". 4.11 State and prove the theorem "If two rows or two columns of a matrix are interchanged, the sign of the value of its determinant is changed". 4.12 State and prove the theorem "If two rows or two columns of a matrix are interchanged, the sign of the value of its determinant is changed" 4.13 State and prove the theorem "If a constant terms the elements of a row or a column are added to the corresponding elements of any other row or column, the value of the determinant itself is multiplied by the constant" 4.14 State five examples of each of the theorems in 2. 10-4, 13 above. 4.15 .Define the ad joint of a matrix	➢ State and prove relevant theorems				

	4.16 Define the inverse of a matrix. 4.17 State the linear transformations on the rows and columns of a matrix. 4.18 Apply Cramer's rule in solving simultaneous linear equation. **4.19** Apply linear transformation in solving simultaneous linear equations.					

PROGRAMME: NATIONAL INNOVATIVE DIPLOMA
COURSE TITLE: TRIGONOMETRY AND ANALYTICAL GEOMETRY
CODE: MAT 221
DURATION: 30 hours/week
YEAR: 2 **SEMESTER** 1
UNITS: 2.0

GOAL: This course is intended to give the student basic understanding of trigonometry and Analytical Geometry and apply same to Engineering problems.

GENERAL OBJECTIVES:

On completion this course, the student will be able to: -

1. Understand the manipulation of trigonometric formulae and equations
2. Understand the concept of mensurations and its application to Engineering problems
3. Understand the concept of Analytical Geometry and its applications.
4. Know the different forms of conic sections such as Ellipse, Parabola and Hyperbola

	Course: Trigonometry and Analytical Geometry	Course Code: MTH 122		Credit Hours: hours/week
		Contact Hours:		Theoretical: hours/week
	Year:	Pre-requisite:		Practical: hours /week
	Theoretical Content			Practical Content

Week	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	General Objective 1.0: Understand the manipulation of Trigonometric Formulae and equations.					
	1.1 Covert sums and differences of Trigonometric ratio to products: $\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A+B)}{2}$ $\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A+B)}{2}$ 1.2 Prove the sine and cosines formulae of triangles. 1.3 Solve triangle using the sine and cosine formulae e.g.:- The sides a,b,c, of a triangle are 4cm, 5cm, and 6cm respectively. 1.4 Calculate angles of elevation and depression using trigonometric ratios e.g.: From the top of a tree 120m high an observer sees a boat 560 m away. Calculate the angle of depression.	• Explain with relevant examples.				
	1.5 Compute bearings, heights and distances of inaccessible objects and projections, e.g.:- A man walks 3km due N. and the 3 km N.52°W. How far is he of his starting point? What is his bearing from his original position 1.6 Derive half angle formulae from sin, cos and tan. 1.7 Define inverse circular functions. 1.8 Represent inverse circular functions graphically					

	1.9 Solve problems involving 1.8 above e.g.:- Draw the graph of $\frac{1}{\text{Cos } 2Q}$ for Q taking values from 0° to 90° inclusive. 1.10 Apply the concepts in 1.8 above to three dimensional problems.					

	General Objective 2.0: Understand the concept of Mensuration and its application to Engineering problems.					
	2.1 Explain circular measure. 2.2 State the relation between radians and degrees. 2.3 Derive the formulae for arc length and area of a sector. 2.4 Identify segment and chord of a given circle. 2.5 Determine the area of a segment and the chord length of a given circle. 2.6 Calculate the surface areas and volumes of simple shapes such as cylinder, sphere and cone e.g. a solid sphere has radius 8 cm. Calculate its volume. 2.7 Determine the areas and volumes of irregular shapes applying Simpsons rule. 2.8 Apply mid-ordinate rule to determine the areas and volumes applying mid-ordinate rule.	• Explain with relevant examples				
	General Objective 3.0: Understand the concept of Analytical Geometry and their applications.					
	3.1 Explain two dimensional coordinate systems: C artesian and Polar-coordinate systems. 3.2 Explain plotting and sketching of graphs w.r.i. the two coordinate systems. 3.3 Relate Cartesian coordinate to polar coordinates. 3.4 Explain the slope of a line in relation to the above concepts in					

	3.3 above. 3.5 Explain the intercept of a line. 3.6 Derive the formula for the gradient of line passing through two points. 3.7 Derive the equation of a straight line given the gradient and the co-ordinates of a point. 3.8 Reduce a given linear equation to the intercept form. $\frac{X}{a} + \frac{Y}{b} + 1$ 3.9 Determine the coordinates of the point of intersection of two Straight lines. 3.10 Define locus. 3.11 Derive the slope-intercept form of the equation of a straight line: $y = mx+c$ 3.12 Derive the point – slope form of the equation of a straight line: $y - y, = m (x - x,)$					

	3.13 Derive the perpendicular form of the equations of the straight line. $y - y, = \frac{y_2 - y_1}{‘x_2 - ‘x_1} (x-x,)$ 3.14 Derive the perpendicular form of the equation of a straight line Cos x + ysin x = P 3.15 Give examples of 3.11 to 3.14 above. 3.16 Find the angle (Q) between two lines whose slopes (m, and m_2) are known: $Q=\tan \frac{(m_2 - m_1)}{1+ m_1 m_2}$ 3.17 Determine the conditions for two lines to be parallel and to be perpendicular. 3.18 Derive the expression for the perpendicular distance from a point to a line. 3.19 Draw a circle. 3.20 Derive the equation of a circle with centre at the origin and radius r. 3.21 Derive the equation of a circle with centre outside the origin. 3.22 State general equation of a circle. 3.23 Determine the coordinates of the centre of a circle from a given equation of a circle.	• Explain with relevant examples				

	3.24 Draw orthogonal circles. 3.25 Obtain the equation of the tangent and the normal at a point circle. 3.26 List illustrative examples of each of 3.20 to 2.25 above.					
	General Objective 4.0: Know the different forms of conics such as eclipse, Parabola and hyperbola.					
	4.1 Define the parabola. 4.2 Derive the standard equation of a Parabola $y^2 + 4ax$. 4.3 State the properties of parabola. 4.4 Define the focal chord, axis and latus rectum of the parabola. 4.5 Determine the equation of the tangent and normal from a given point to the parabola. 4.6 Solve problems on parabola e.g. Write down the equation of the parabola and state its vertex if the focus-is (2, 0) and the directrix x= -2. 4.7 Define an ellipse. 4.8 Derive the equation of an ellipse $\frac{x^2}{9^2} + \frac{y^2}{6^2} = 1$ 4.9 State the properties of the ellipse. 4.10 Determine the equation of the tangent and the normal to an ellipse from a given point. 4.11 Define focal chord and axes of ellipse.					

	4.12 Solve problems on ellipses e.g. Find the length of the axes and the eccentricity for the ellipse: $4x^2 + 9y^2 = 36$ 4.13 Define the Hyperbola. 4.14 Derive the equation of the Hyperbola - $\frac{x^2}{9^2} - \frac{y^2}{6^2} = 1$ 4.15 Identify the properties of the Hyperbola. 4.16 Define asymptotes, chord, tangent and normal to a hyperbola. 4.17 Solve problems on hyperbola e.g. Find the foci and directrix for hyperbola: $\frac{x^2}{16} - \frac{y^2}{9} = 1$ 4.18 Define rectangular hyperbola. 4.19 Determine tangent and normal to the rectangular hyperbola.					

PROGRAMME: **NATIONAL INNOVATION DIPLOMA**
COURSE: **CALCULUS**
CODE: **MAT 232**
COURSE UNIT **3**
DURATION: **45 HRS** **HOURS/WEEK** **Lecture : 2 hrs** **Tutorial: 1 hr**
SEMESTER : **2** **YEAR: 2**
GOAL: This course is intended to enable the students acquire the basic knowledge of differential and integral calculus and apply same in solving problems.

GENERAL OBJECTIVES:

On completion of this course, the student should be able to:

1.0 Understand the basic concepts of differential calculus and its application in solving engineering problems.
2.0 Know integration as the reverse of differentiation and its application to engineering problems.
3.0 Understand first order ordinary differential equation's with constant coefficients as applied to simple circuits.

	Course: Calculus	Course Code: MAT 232		Credit Hours: 2 hours/week
		Contact Hours:		Tutorial: 1 hours/week
	Year: 2 SEMESTER 2	Pre-requisite:		
	Theoretical Content			Practical Content

Week	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	General Objective 1.0: Understand the basic concepts of differential calculus and its application in solving engineering problems.					
	1.1 Define limits with examples. 1.2 State and prove basic theorems of limits. 1.3 Prove $\underset{\theta \to 0}{Lim} \frac{\sin \theta}{\theta} = 1$ $\underset{\theta \to 0}{Lim} \frac{\tan \theta}{\theta} = 1$ 1.4 Define differentiation as an incremental notation or a function. 1.5 Differentiate a function from first principles. 1.6 Prove the formulae for derivative of functions, Function of a function, products and quotient of functions. 1.7 Differentiate simple algebraic, trigonometric, logarithmic, exponential, hyperbolic, parametric, inverse and implicit functions. 1.8 Derive second derivative of a function.	• Explain with relevant examples	Relevant text books, Chalk board			
	1.9 Apply differentiation to simple engineering and technological problems. 1.10 Explain the rate of change of a function.	• Explain with relevant examples	Relevant text books, chalk board			

	1.11 Explain the condition for turning point of a function. 1.12 Distinguish between maximum and minimum value of a function. 1.13 Ketch the graph of a function showing its maximum and minimum points and points of inflexion. 1.14 Estimate error quantities from the small increment of a function. 1.15 Determine the tangent to a curve. 1.16 Determine the normal to a curve.					

	General Objective 2.0: Know integration as the reverse of differentiation and its application to engineering problems.					
	2.1 Define integration as the reverse of differentiation. 2.2 Define integration as a limit of summation of a function. 2.3 Distinguish between indefinite and definite integrals. 2.4 Determine the indefinite integral of a function. 2.5 Determine the definite integral of a function.	Explain with relevant examples. Class assignment	Relevant text books, chalk board			
	2.6 Integrate algebraic, logarithmic, trigonometric and exponential simple function. 2.7 List possible methods of integration. 2.8 Integrate algebraic and trigonometric functions by the substitution method. 2.9 Integrate trigonometric and exponential functions by parts. 2.10 Integrate algebraic functions by partial fraction. 2.11 Integrate trigonometric and logarithmic functions applying reduction formula. 2.12 Sate standard forms of some basic integrals. 2.13 Calculate length of arc, area under a curve, area between two curves, volume of revolution, centre of gravity, centre of surface area, second moment and					

	moment of inertia. 2.14 Define Trapezoidal and simpson's rule as methods of approximate areas under given curves. 2.15 Find approximate area under a curve applying Trapezoidal method. 2.16 Find approximate area under a curve applying Simpson's rule.					

	2.17 Compare results obtained from Trapezoidal and simpson's rules with the results by direct integration. 2.18 Apply integration to kinematics.					
	General Objective 3.0: Understand first order ordinary differential equations with constant coefficients as applied to simple circuits					
	3.1 Define first order differential equation. 3.2 List order, degree, general solution, boundary or initial conditions and particular solution of differential equations. 3.3 List examples of various types of first order differential equation. 3.4 Define first order homogeneous differential equations. 3.5 List the methods of solving differential equations eg. by separable variables. 3.6 Identify differential equations reducible to the homogeneous form. 3.7 Define an exact differential equations. 3.8 Solve exact differential equations e.g. (a) show that $(3x^2+y \cos x)dx+(\sin x-4y^3)dy=0$ is an exact differential equation. (b) Find its general solution. 3.9. Define linear differential equations of the first order. 3.10 Define integrating factor.					

	3.11 Determine the solution of linear differential equation using integrating factors.					

PROGRAMME: NATIONAL INNOVATION DIPLOMA

COURSE: BUSINESS MATHEMATICS 1
CODE: MAT 241
UNITS: **2**
DURATION: 2HOURS/WEEK Lecture : 2 Tutorial
SEMESTER : 1 YEAR : :
GOAL: This course is designed to provide the student of business studies with the knowledge of mathematics that will enable him understand calculations in his/her profession.

GENERAL OBJECTIVES: on completion of this course, the student will be able to:

1.0 Understand the concept and applications of formulae to Business Management.
2.0 Understand the concept and applications of indices and logarithm.
3.0 Understand the concept of sequence and series and their applications to Business Management.
4.0 Understand the concepts of simple and compound interests, annuity, present value and discounts.
5.0 Understand investment appraisal, the test and the application to financial management.
6.0 Understand the concepts of equations and inequalities and applications in solving Business problems.
7.0 Understand the construction and interpretation of graphs and their applications to Business problems

	Course: Business Mathematics. 1	Course Code: MAT 241		Credit Hours: hours/week
		Contact Hours: 2		
	Year: 2	Pre-requisite:		Practical: hours /week
	Theoretical Content			Practical Content
	General Objective 1.0: Understand the concept and applications of formulae to Business Management.			

Week	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
	1.1 Explain the concept of formula. List examples of formula e.g. $A=P(1+\frac{r}{100})^n,\ I=\frac{PRT}{100},$ $S=ut+ft^2$ 1.3 Explain the summation sign (sigma). 1.4 Apply the concepts in 1.3 above to problems of Business Management.	• Explain with relevant examples.		Solve problems and application on formulae		
	General Objective 2.0: Understand the concept and applications of indices and Logarithm.					
	2.1 Explain an index. 2.2 Evaluate the product and quotient of indices. 2.3 Evaluate the value of an index raised to an exponent. 2.4 Define logarithms. 2.5 State the laws of logarithm. 2.6 Explain change of base. 2.7 Apply the concepts in 2.4 - 3.7 above to problems of business management.	• Explain with relevant examples.				

	General Objective 3.0: Understand the concept of sequence and series and their applications to Business Management.					
	3.1 Define Arithmetic Progression (A.P.) 3.2 Derive the formula for the nth term of an A.P. 3.3 Derive the formula for the sum of the first n term of a G.P. 3.4 Define geometric series (G.P.) 3.5 Derive the formula for the nth term of a G.P. 3.6 Derive the formula for the sum of the n terms of a G.P. 3.7 Compute the sum of a finite G.P. 3.8 Compute the sum of a convergent infinite G.P. 3.9 Apply the above concepts to Business Management.	• Explain with relevant examples.				
	General Objective 4.0: Understand the concepts of simple and compound interest, annuity, present value and discount.					
	4.1 Define simple and compound Interests. 4.2 Define annuity. 4.3 Compute annuity with simple interest. 4.4 Compute annuity with compound interest. 4.5 Compute the value of land, equipment, etc or money according to present value concepts. 4.6 Compute the monetary worth of materials with discount concept. 4.7 Apply the concepts in 4.1 to 4.4 above to financial management.	• Explain with relevant example				

	General Objective 5.0: Understand investment appraisal, the test and the application to financial management.					
	5.1 Define the discounting techniques. 5.2 Describe the discounting techniques using the cash flow method. 5.3 Determine the choice of the techniques to be applied. 5.4 Apply discount technique concepts to problems in financial management.					
	General Objective 6.0: Understand the concepts of equations and inequalities and applications in solving Business problems.					
	6.1 Explain the concept of an equation, i.e. A=B, where A and B are expressions. 6.2 List different types of equations: linear, quadratic, cubic etc. 6.3 Give examples of simultaneous equations: i) linear, linear ii) linear, quadratic iii) quadratic, quadratic 6.4 Solve simultaneous equations by means of algebraic and graphical methods. 6.5 Explain factorization. 6.6 Factorise a given expression. 6.7 Solve given equations by completion of squares. 6.8 Explain the use of quadratic formula. 6.9 Explain signs of inequality.					

	6.10 Solve equations involving inequalities.					
	General Objective 7.0: Understand the construction and interpretation of graphs and their applications to Business problems.					
	7.1 Solve two simultaneous linear equations by graphical method e.g.: Find the values of (x,y) which satisfy the equations $y+x= 12$ and $y=x^2+6$. 7.2 Solve two simultaneous equations: linear and quadratic by graphical methods. (See 7.1 above).					
	7.3 Solve two simultaneous equations: quadratic and quadratic by graphic method. 7.4 Identify the slope and intercept of given equation of straight lines. 7.5 Plot straight line graphs given a set of coordinates of points or the slope and intercept. 7.6 Sketch the graphs of simple functions. 7.7 Apply the concept in 7.6 above to Business problems.					

PROGRAMME: NATIONAL INNOVATION DIPLOMA
COURSE: BUSINESS MATHEMATICS II
CODE: MAT 252
COURSE DURATION 30 HRS
SEMESTER : 2 YEAR : 2

GENERAL OBJECTIVES: on completion of this course, the student will be able to:

1.1 Understand the basic concepts of differential calculus and the applications to Business problems.
1.2 Understand definite and indefinite integrals and the application to cost and areas.
1.3 Understand sets, permutation, combination and their applications in counting.
1.4 Understand binomial expansion and application to Business problems.
1.5 Understand matrices and their applications to Business problems.
1.6 Understand the elements of Management mathematics as applied to linear programming.

General Objective 1.0: Understand the basic concepts of differential calculus and the applications to Business Problems.			
1.1 Define the limiting value of a function. 1.2 Apply the limiting value to the slope of a tangent line. 1.3 Define continuity of a function. 1.4 Define differentiation as an incremental notation of a function. 1.5 Differentiate a function from first principles. 1.6 State the formulae for derivative of a function, function of a function, products and quotients of functions. 1.7 Differentiate simple algebraic, trigonometric, logarithmic, exponential hyperbolic, parametric, inverse and implicit functions.	Explain with relevant examples		
1.8 Obtain second derivative of a function. 1.9 Explain the condition for turning point of a function. 1.10 Distinguish between maximum and minimum values of a function of 2^{nd} degree. 1.11 Sketch a quadratic function and indicate its turning points. 1.12 State the conditions for the maximum and minimum of simple multivariate functions of three independent variable. 1.13 Apply the concepts in 1.12 above to marginal concept. Finding optimum point cost and solving cost and profit problems in finance management.			

General Objective 2.0: Understand definite and indefinite integrals and the application to cost and areas.			
2.1Define integration. 2.2 List the methods of integration. 2.3 Solve problems using the methods of integration for both definite and indefinite integrals. $I = \int x dx : I = \int \frac{dx}{x^2}, I = \int \frac{8x-3}{2x^2+2x+1} dx$ 2.4 Apply the concepts of integration to costs and areas.			

	General Objective 3.0: Understand sets, permutation, combination and their applications in counting.					
	3.1 Define sets. 3.2 Define subsets, disjoint and non-disjoint sets. 3.3 State the laws of sets. 3.4 Illustrate operations of sets using Venn diagrams. 3.5 Apply sets of Business problems. 3.6 Define permutation and combination. 3.7 List examples of permutation and combination. 3.9 Solve problems on permutation and combination e.g: a) In how many ways can 8 officers be assigned 5 different posts in a company? b) If the 5 posts are declared to be equivalent, how many ways can the 8 officers be assigned. 3.10 Apply permutation and combination in business methods.	**Explain with relevant examples**				
	General Objective 4.0: Understand Binomial expansion and application to Business problems.					
	4.1State Binomial Theorem. 4.2 Explain the Pascals triangle and its' use. 4.3 Expand $(x + y)^n$, etc where n is an integer, applying binomial theorem. 4.4 Find terms involving the power of					

	x in the expansion of $(x+y)^n$ etc. 4.5 Apply the concepts in 4.4 above, in financial management.					

	General Objective 5.0: Understand matrices and their applications to business problems.					
	5.1 Define matrix. 5.2 State the properties of matrices. 5.3 List types of matrices. 5.4 Add, subtract and multiply matrixes. 5.5 Explain determinants. 5.6 State properties of determinants. 5.7 Evaluate the determinant of a matrix. 5.8 Explain the rank of a matrix. 5.9 Determine the inverse of a matrix. 5.10 Determine the transpose and adjoint of a matrix. 5.11 Solve linear equations by the following methods: i) Gramer's Rule ii) Gaussian method iii) Inverse of matrix e.g. solve the following system of linear equations by Cramer's rule: 2x+y-z=0 x-y+ z=6 x+2y +z=3 5.12Explain the concept of the rank of a matrix in input/output analysis.	**Explain with relevant examples**				

	General Objective: 6.0. Understand the elements of management mathematics as applied to linear programming. 6.1 Explain linear programming 6.2 Translate management problems into linear equations. 6.3 Identify the different types of methods used to solve linear programming problems. 6.4 Solve linear programming problems using graphical methods. 6.5 Solve linear programming problems using simplex methods. 6.6 Identify the advantages of graphical and simplex methods.					

PROGRAMME: NATIONAL INNOVATION DIPLOMA

COURSE TITLE: DESCRIPTIVE GEOMETRY
COURSE CODE: MAT 261

COURSE UNIT 2.0
COURSE DURATION 30 HRS
YEAR: 2 SEMESTER: 1

Goal: This course is intended to provide the trainee with the basic knowledge of the application of geometrical methods in the analysis and solution of elementary space problem.

General Objectives:

On completion of this course the students should be able to:

1. Understand the principles and application of loci.
2. Know the true lengths, angles and surfaces from given projected view.
3. Understand simple auxiliary plans and elevations.
4. Know the line of intersection between meeting surfaces.

PROGRAMME: NATIONAL INNOVATIVE DIPLOMA						
COURSE: Descriptive Geometry			**COURSE CODE**: MAT 261		**CONTACT HOURS**: 30 Hours	
GOAL: This course is intended to provide the trainee with the basic knowledge of the application of geometrical methods in the analysis and solution of elementary space problem.						
COURSE SPECIFICATION: Theoretical Contents:				**Practical Contents**:		
	General Objective: 1.0 Understand **the principles and application of loci.**			**General Objective**:		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Define the locus of a point. 1.2 Draw and give examples of application of ellipse, parabola and hyperbola. 1.3 Define and draw helix, involutes and cycloid curve and state their applications. 1.4 Solve problems, involving link mechanism.	❖ Give definition of locus as a set of points on a curve satisfying a given condition ❖ Distinguish between parabola, hyperbola and ellipse ❖	➢ Chalk Board ➢ Text Book ➢ Rulers ➢ Thread ➢ Pair of Compasses ➢ Setsquares t	Draw helix ,involutes and Cycloid	Use thread to demonstrate the nature of helix and involutes Demonstrate the use of various conic sections in everyday life	➢ Chalk Board ➢ Text Book ➢ Rulers ➢ Thread ➢ Setsquares ➢ Math Set
	General Objective: 2.0 Determine the true lengths, angles and surfaces from given projected view.					

WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	2.1 Recognize true and foreshortened lines and surfaces in projected views. 2.2 Draw projected view of inclined lines on the principal planes and determine their true lengths. 2.3 Determine the true angle of inclined lines to the principal plane. 2.4 Draw projected views of an inclined plane to the principal plane and determine the true shape and T-angle of inclination i.e. dihedral angle.	❖				➢ Drawing Board ➢ Set Squares ➢ Trisquare ➢ Drawing Paper
	General Objective: 3.0 Draw simple auxiliary plans and elevations.					

WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	
	3.1 State the rules for projecting 1st and 2nd auxiliary plans and elevations from normal views. **3.2** Determine or draw in given position auxiliary plans and project auxiliary elevations and planes from principal view of simple machine.	❖ Explain with relevant examples	➢ Text Book ➢ Rulers ➢ Pair of Compasses ➢ Setsquares ➢ Math Set			
	General Objective: 4.0 Determine the line of intersection between meeting surface.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	4.1 Use auxiliary and cutting plane methods to determine the line of intersection of two meeting surface e.g.		➢ Drawing Instruments.			

	intersecting cylinders, intersecting ducts, prisms, lines, etc. 4.2 Explain with sketches the use of parallel line, radical line and triangulation methods of development. 4.3 Use appropriate method to develop simple surface e.g. intersecting cylinders, prisms, pyramids, oblique lines, transition pieces (square to square, rectangular to fund round to square or rectangular), etc.					

PROGRAMME: NATIONAL INNOVATION DILOMA

COURSE MATHS FOR COMPUTER (ALGEBRA I)

CODE: MAT 272

UNITS: **3 Units**

DURATION: HOURS/WEEK Lecture: 2hrs Tutorial: 2hrs Practical

GOAL: This module is designed to acquaint the leaner with the knowledge of mathematics used for electronics data processing.

GENERAL OBJECTIVES: On completion of this module the leaner should be able to:

1. Know number system, codes and code conversion
2. Understand Binary arithmetic.
3. Understand the concept of algorithm and flow chart

	Theoretical Content			Practical Content		
	General Objective 1.0: Know number system					
Week	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
	Ability to: 1.1 Describe the binary, octal, decimal and hexadecimal number system. 1.2 Convert from one number system to another e.g. decimal to binary e.t.c. 1.3 Define a code. 1.4 Explain the conversion from one code to another. 1.5 Describe and explain a code. 1.6 Describe the BCD code, excess-three code and 2+421 codes. 1.7 Describe the conversion from one code to another e.g. from BCD to excess-three code. 1.8 Explain logic gates AND OR NOR,XOR, XNOR ,NAND	Explain with examples on different counting systems e.g. Binary , octal, decimal etc				
	General Objective 2: Understand binary arithmetic					
	2.1 Sate the Boolean postulates: the commutative law, associative law, Distributive law, identify law, Negation	2.1 State, explain and relate the Boolean postulate request the student to list examples of Boolean	PC connected to an OHP projector. Power point	Ability to design and implement Boolean	Assist student in their practical	Networked PC lab, with MS office professional

	Law, Redundancy law, and De Morgan's theorem. 2.2 Construct a truth table for up to 4 variables. 2.3 Form logic expression from statements of conditions. 2.4 Minimize a logic expression algebraically. 2.5 Explain a karnaugh map (K.Map) 2.6 Construct a .K –Map for 2,3,4 variable. Minimize a logic expression using a k-map	pastorate's application. 2.2 Design a truth table for up to 4 variables. 2.3 Design logic expression from statements of condition. 2.4 Using the stated Boolean postulate explain the steps in minimizing a logic expression algebraically, there after, demonstrate the action. 2.6 Define and discuss the karnaugh map. 2.7 Progressively design a karnaugh map for 2 variable, 3 and 4 variables and explain each step 2.9 Use the principles in K-Map and minimize logic expression.	presentation of lecture notes. Online lecture notes. White board.	logical equations.	work	Logic Simulator packages such as Electronic work Bench, or Digital work.
	General Objective 3: Understand the concept of algorithm and flowcharting					
	3.1 Define algorithm on very general basis 3.2 Describe all ANSI flowcharts as					

	descriptive algorithm 3.3 Draw flowcharts as descriptive algorithm					

LIST OF PARTICIPANTS: IEI MATHEMATICS

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1.	Attah Felix	Akanu Ibiam Federal Polytechnic, Unwana Afikpo
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4.	G.M.A. Adedokun	The Polytechnic, Ibadan
5.	Engr. Dr. Nuru A Yakubu,OON	Executive Secretary, NBTE Kaduna
6.	Dr. M S Abubakar	Director of Programmes NBTE, Kaduna
7.	Mr. O E Okafo	HOD Agric. & Science, Division, NBTE, Kaduna
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10.	Bashir Jamilu	National Board for Technical Education, Kaduna