CBN COLLABORATIVE POSTGRADUATE PROGRAMME
DEPARTMENT OF ECONOMICS, UNIVERSITY OF NIGERIA NSUKKA
WORK PLAN
NAME OF LECTURER:
COURSE: ECO 505 QUANTITATIVE METHODS

STUDY WEEK	TOPIC SUB-TOPIC	RESULTS LEARNING	TIME Hrs	METHODS	Suggested Videos
1-4	**MATRIX ALGEBRA** 1.1 Matrix algebra and system of linear equations 1.2 System of linear equations with economic applications, including input-output model 1.3 Eigenvalues and eigenvectors 1.4 Quadratic forms	Students will be able to: ▪ Present simultaneous equations in matrix form ▪ Solve for the unknowns in a system of equations using variety of methods ▪ Distinguish between singular and non-singular matrix, and determine the inverse of a square matrix ▪ Apply matrix knowledge to solving economic issue like national income ▪ Use matrix knowledge to determine the optimum output in an economy from different sector, using input-output model ▪ Explain the meaning of Eigenvalues and eigenvectors ▪ Calculate the Eigenvalues and eigenvectors of a matrix ▪ Interpret the Eigenvalues and eigenvectors figures ▪ Solve for binary form of equations ▪ Use the discriminant as an invariant ▪ Classify positive form of equations: reduced form, ▪ Represent integers by quadratic forms. ▪ Determine the Composition of forms ▪ Perform Reduction of positive quadratic forms	12	Face-to-face interaction and presentations	

5-8	**ECONOMIC APLICATION OF CALCULUS AND STATIC OPTIMIZATION** 2.1 Univariate differential calculus 2.2 Applications of univariate optimization 2.3 Applications of multivariate differential calculus 2.4 Applications of extreme values of multivariate functions 2.5 Applications of unconstrained optimization 2.6 Applications of integral calculus	Students will be able to: ▪ Apply Rules of differentiation ▪ Compute the derivative and extrema points of a non-linear function ▪ Explain Mean Value Theorem and Its Applications to single variable equation or function ▪ Explain the Fundamental Theorem of Calculus and Its Applications to more than one variable functions. ▪ Identify absolute and local extreme points from a set of critical points and endpoints ▪ Finding the Extreme Values Using Calculus Techniques ▪ Distinguish critical points that are not extrema. ▪ Determine the optimization points of an economic function ▪ Distinguish between minimization and maximization problems and where it occurs. ▪ Derive decision on optimal output, input, profit, etc. ▪ Solve real world system nonlinear optimization models with constraints for which analytical solutions are not available. ▪ Be sufficiently familiar with a range of numerical methods for solving nonlinear optimization problems ▪ Apply properly the resulting algorithms to solving practical optimization problems ▪ Understand the theoretical background behind each of the methods. ▪ Understand optimality conditions for both unconstrained and constrained optimization problems and use them to identify optimal solutions of simple academic examples	12	Face-to-face interaction and presentations	

9-11	**DYNAMIC ANALYSIS AND OPTIMIZATION** 3.1 Dynamic Analysis 3.1.1 Applications of difference equations 3.1.2 Applications differential equations 3.2 Applications of dynamic optimization *3.2.3 Calculus of variations* *3.2.1 Dynamic optimization in discrete time* *3.2.2 Optimal control theory*	Students will be able to: ▪ Solve dynamic problem with time dimension. ▪ Solve dynamic equations that are of continuous and discrete forms ▪ Generate first linear equation ▪ Solve for particular, general, and complementary solution. ▪ Apply knowledge to discrete time process with time domain problems ▪ Generate standard first-order difference equation ▪ Apply to wealth accumulation, consumption, savings, income, etc. in discrete time ▪ Determine the order of a difference equation and distinguish between linear and non-linear, as well homogeneous or non-homogeneous. ▪ Solve simple first and second order differential and difference equations; ▪ Use Maple to study elementary differential and difference equations; ▪ Understanding of simple applications of differential and difference equations in population dynamics. ▪ Apply to practical economics field, such as: simple interest, loan repayment, population issue, ▪ Apply difference equation knowledge to real life economic examples. ▪ Familiarize the student with the theoretical and numerical issues associated with nonlinear programming and optimal control problems. ▪ Grasp basic analytical tools for future research. ▪ Provides insight into numerical techniques for effectively solving practical problems. ▪ Understand the problems, methods and techniques of calculus of variations Study modern optimal control theory ▪ Treat extensively single integral problems in one and more unknown functions	9	Face-to-face interaction and presentations	

12-13	**INTRODUCTION TO SET THEORY AND REAL ANALYSIS** 4.1 Set Theory 4.2 Real Analysis	Students will be able to: ▪ Explain the principle of inclusion and exclusion ▪ Apply the principle to solving set problem ▪ Represent set solution in venn diagram Students will be able to: ▪ Demonstrate understanding of the real numbers, their axioms and the role of completeness in the existence of limits and solutions to equations ▪ Interpret and apply quantifiers in mathematical statements, and quote and apply basic theorems in analysis. ▪ Calculate limits of sequences and (power) series, and prove/disprove convergence using the definitions ▪ Manipulate simple inequalities; ▪ Define convergence of sequences and series; ▪ Introduce continuity and differentiation and prove some fundamental properties of continuous and differentiable functions; ▪ Apply definitions & theorems presented throughout the course to solve unseen problems; ▪ State and prove some fundamental theorems; ▪ Understand concepts of convergence for sequences and series. ▪ Understand definitions of boundedness, continuity, uniform continuity, differentiability and determine by proof whether certain functions possess said properties.	6	Face-to-face interaction and presentations	
14	**REVISION WEEK**				
15	**FINAL EXAMINATION**				

Lecturer:

PROGRAMME LEADER