LEAD CITY UNIVERSITY

Faculty of Social and Management Sciences
Department of Economics

COURSE PARTICULARS

Course Code: ECO 213
Course Title: Mathematics for Economists II
Number of Units: 2
Status: Compulsory

LECTURERS   DETAIL

Name: (1)   Dr. Foye V.O.

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Area of Specialization: Energy Economics

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Area of Specialization: Monetary Economics

COURSE DESCRIPTION

Integral Calculus; definite and indefinite integrals; and their properties; integration of exponential and log functions with applications in Economics; introduction to differential and difference equations; standard treatment of linear algebra with applications; matrices and determinants and their applications in economics.

COURSE OBJECTIVES

This course is designed to improve the knowledge of the students in mathematical economics building on what they learnt in ECO 211. It will expose the students to topics like Integral Calculus, Differential equation, and simultaneous equations. The course will provide the basic requirements for microeconomics, macroeconomics and mathematical economics at the higher levels.

ASSESSMENT

Attendance   10 marks

Test	20 marks
Exam	70 marks
Total	**100 marks**

LECTURE PLAN

Week	Topic
Week 1	**Integral Calculus I** Integration Rules of integration Tutorials
Week 2	**Integral Calculus II** Definite Integral Properties of Definite integral Application in Economics Tutorials
Week 3	**Integration of exponential & Logarithm function** Exponential function Logarithm function Integration of exponential & logarithm function Application in Economics Tutorials
Week 4	**Linear Algebra I** Role of Linear algebra Addition, subtraction, scalar multiplication Vector multiplication, multiplication matrices Tutorials
Week 5	**Linear Algebra II** Further Operation on matrices Properties of determinants Matrix expression of a system of Linear Equation Tutorials
Week 6	**Matrix Inversion** Determinants and non-singularity Minors and cofactors Cofactors and Adjoint Inverse of matrices Solving Linear Equation with the Inverse Tutorials
Week 7	**Cramer's Rule** Solving system of Linear Equation by Crammer's rule Application in Economics

	Tutorials
Week 8	**Set Theory** Concept of Set Operation on Sets Laws of sets operations Application/Examples in Economics Tutorials
Week 9	**Introduction to Differential Equation I** Definition & Concepts General formula for first Order Linear Differential Equation Application in Economics Tutorials
Week 10	**Introduction to Differential Equation II** Exact Differential Equation Phrase diagram for differential equations Application in Economics Tutorials
Week 11	**Simultaneous Equation** Definition and the concepts Solving simultaneous equation Application in Economics Tutorials
Week 12	**Revision**

READING LISTS

1. Chiang, Alpha C and Kevin Wainwright (2005) **Fundamental Methods of Mathematical Economies,** McGraw-Hill Companies Incorporation New York.
2. Dowling, Edward T. (2012) **Introduction to Mathematics Economics**, Schaum's outline series, Third Edition, McGraw-Hill, New York.
3. Jacques, Iran (2006) **Mathematics for Economics and Business,** Pearson Education Limited, New York.
4. Fabayo J. A. (1996) **Mathematical Analysis in Economics.** OAU Press, Ile Ife, Nigeria.
5. Onimode, B and Osayinwese, I (1984) **Basic Mathematics for Economics,** George Allen and Unwin, UK.

TUTORIAL QUESTIONS

1. (a) Find the integral of

$$\int 32x(x+5)^4 \, dx$$

(b) The investment rate of MABEL PLC, a manufacturing company of repute in Ibadan is derived as I = 120t $^{1/3}$ and the capital stock at t = 0 is 200. You are required to find the capital function, K

(c) Evaluate the following:

(i) $\int_3^5 3x^2 (x^3 + 1)^{-2} \, dx$

(ii) $\int_2^4 4x(x^2 + 2)^{-5} \, dx$

2. Given the non-linear demand schedule p = 600 – 6q$^{0.5}$ and the corresponding marginal revenue function MR = 600 – 9q$^{0.5}$, use definite integrals to find:

(a) total revenue when q is 2,500;

(b) the change in total revenue when q increases from 2,025 to 2,500;

(c) consumer surplus when q is 2,500

3. An individual has the utility function U=4X$^{0.5}$Y$^{0.5}$ and can buy good X at N2 a unit and good Y at N8 a unit. If their budget is N100, find the combination of X and Y that they should purchase to maximize utility and check that second-order conditions are met using the bordered Hessian matrix.

4. (a) Integrate the following equation

$$\int 32e^{-3x} \, dx$$

(b) The marginal revenue of Titlad food canteen, lead city University, Ibadan is estimated as:

MR = 90-42Q-12Q^2

You are expected to find the total Revenue function and the Price function

(c) Write out the general formula for solving a first-order linear differential equations

5.   Define the following terms and give examples as necessary (a) Matrix (b) Minors   (c)   Co-factors of a matrix (d) Transpose of a matrix (e) Inverse of a matrix

6.   Out of a group of 60 companies, 25 have offices in Lagos, 32 have offices in Kaduna, and 28 have offices in Aba. Furthermore, 15 have offices in Lagos and Kaduna, 12 have offices in Lagos in Aba, and 17 have offices in Kaduna and Aba. Also, 8 companies have offices in all the three locations.

Use venn diagrams to determine how many of the 60 companies do not have offices in any of the three locations and how many companies have offices only in Lagos.

7.   If the Utility function of a Consumer is of the form: U = 5YX + X and the budget function is given as 2Y+X = 30.

(a) Determine the level of commodity Y and X for which utility is maximized.

(b) What is the maximised utility of the consumer?

(c) Let the production function of a particular firm exhibit Cobb-Douglas   production

   function of the form $Q = AK^\alpha L^\beta$ where $(\alpha+\beta) = 1$. Find the marginal product of labour

   and the marginal product of capital.

8.   The employees of a firm totaling 1422 in a number are offered the opportunity to participate in   three different types of savings scheme: Future security (F), Health Insurance (H), and Children education (C) of this, 100 participate in all the three saving schemes. A total of 760, 600 and 800 participate in F, H and C, respectively. If 260 of the employees participate in F and H, and 240 participate in H and C and another 220 participate in F and C. Using the principle of inclusion and exclusion calculate:

   (i)   The number of employees participating in at least one of the three schemes

   (ii)   The number of employees not participating in any of the three schemes

   (iii)   The number of employees participating in C only

   (iv)   The number of employees participating in H only

   (v)   The number of employees participating in F and C schemes

9.   Two firms X and Y in an oligopolistic market take a shortsighted view of their situation   and set price on the basis of their rivals' price in the previous time period according to the   reaction functions

$$P^X_t = 300 + 0.75P^Y_{t-1}$$

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Assume that each adjusts its price every other time period. The market is initially in equilibrium with $P^X_t = P^Y_t = 1,200$. Firm X then decides to try to improve its profits by raising price to 1,650. Taking into account the reactions to rivals' price changes described in the above functions, calculate what X's price will be in the eighth time period after its breakaway price rise.

10a . Define and give example of the following:

(i) Definite integral (ii) Indefinite integral

(b)   Assuming that the rate of investment is described by the function $I(t) = 12t^{1/3}$ and that $K(0) = 25$

(i)   find the time path of capital stock K

(ii)   find the amount of capital accumulation during the intervals (0,1) and (1,3) respectively.

11(a)   Using a method of linear algebra, find the inverse of the matrix

$$A = \begin{pmatrix} 8 & -1 & 0 \\ 0 & 2 & 5 \\ 2 & 0 & 3 \end{pmatrix}$$

Hence or otherwise, solve for x_1, x_2 and x_3 in the simultaneous equation model

$$8x_1 - x_2 \qquad = 16$$

$$2x_2 + 5x_3 = 5$$

$$2x_1 \qquad + 3x_3 = 7$$

(b)   Solve the system of equations below using Cramer's rule

$$4x_1 + x_2 - 5x_3 = 8$$

$$-2x_1 + 3X_2 + X_3 = 12$$

$$3X_1 - X_2 + 4X_3 = 15$$

12.   (a) Find the integral of the following equation

$$\int 12x^5 + 20x^3 - 40dx$$

(b) The MC of EE ventures is obtained as:

$$\int 6Q^3 + 13Q^2 - 24Qdx$$

The fixed cost of the outfit is N90. As a chartered economic consultant to the firm, you are expected to calculate the total, variable and the average cost.

(c)   Find the value of the following integral

$$\int_2^7 \left(x^4 + x^2 + 10x - 15\right) dx$$