ELIZADE UNIVERSITY

ILARA-MOKIN

FACULTY: BASIC AND APPLIED SCIENCES
DEPARTMENT: MATHEMATICS AND COMPUTER SCIENCE
1st **SEMESTER EXAMINATION**
2014 / 2015 **ACADEMIC SESSION**

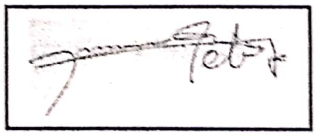
COURSE CODE: MTH201

COURSE TITLE: Mathematical Methods I

COURSE LEADER: Dr. (Mrs.) R. B. Ogunrinde

DURATION: 2½ Hours

HOD's SIGNATURE



INSTRUCTION:

Candidates should answer FOUR Questions from the total of SIX Questions on this Paper.
For each Question 15 marks are available.

Students are warned that possession of any unauthorized materials in an examination is a serious assessment offence

Question 1

a) Using Leibnitz rule obtain the nth derivative of $x^3 \sin x$ (5Marks)

b) If $2x^2 + y^2 = 4$ is y a single –valued function of x? Find the inverse function of f(x) and the interval of definition of f(x). (4Marks)

c) Investigate the continuity of these functions at the given points:

i. $f(x) = \dfrac{3x^2 - 2}{(x-1)(x-4)}$ at x =1 and 4 (2Marks)

ii. $f(x) = x^2$ at x= 5 (2Marks)

iii. $f(x) = \dfrac{\sin x}{x}$ at x =0 (2Marks)

Question 2

a) Show that $f_{xy} = f_{yx}$ for the following functions

i. $f(x,y) = x^2 - xy + y^2$ (3Marks)

ii $f(x,y) = 8x^2 - 3x^2y + 6x$ (3Marks)

b) Expand the function $f(x) = \cos x$ about the point $x = \frac{\pi}{3}$ using Taylor's expansion. Hence evaluate Cos 61 (9Marks)

Question 3

a) Using the definition, prove that $\lim \dfrac{2x^4 - 6x^3 + x^2 + 3}{x-1} = -8$

as x approaches 1. (5Marks)

(b)Classify the following functions under Even, Odd or Neither;

(i) $\sin x$,(ii) $\cos x$, (iii) $x^3 + 4x^2 - 8$ (iv) $x^2 - 5$ (v) $x^5 + 3x$ (5Marks)

c) Show that the expression. $(4x^3y - 2y)dx + (x^4 - 2x)dy$ is exact, hence find the *function* $\emptyset(x,y)$ which is the exact form of the equation. (5Marks)

Question 4

a) Find the directional derivative of $U = 2x^3y - 3y^2z$ $at\ p(1,\ 2-1)$ in the direction towards $Q\ (3,-1,5)$. (10Marks)

b. In what direction is Directional derivative a maximum (3Marks)

c. what is the magnitude of the maximum (2Marks)

Question 5

a) Examine the function

$F(x,y) = x^4 + 4x^2y^2 - 2x^2 + 2y^2 - 1$ for stationary points. (10 marks)

b. State Rolle's Theorem. Hence if the function $f(x) = \sin 4x, a = o, b = \pi/8$

Find $\xi \in (a,b)$ (5marks)

Question 6

a) Find the point on the plane $2x+3y+5z=19$ that is nearest to the origin, using the method of Lagrange multipliers. (6Marks)

b. Expand $x^2y+3y-2$ in powers of (x-1) and (y+2) (6Marks)

c. Evaluate $\int \frac{x^3}{x-2} dx$ (3Marks)

SECTION B: Theory to Practical [30 marks]

1. Samples of water sourced from a well located within the bitumen deposit Zone of Agbabu in Odigbo Local Govt. Area were analysed for iron using spectrophotometric analysis. The results show the following levels of iron in parts per million: 144, 157, 135, 141, 162. Determine the mean, median, standard deviation, Coefficient of Variation , Range and Estimated Standard Deviation (Use the Table below where necessary) **[17 marks]**

N	2	3	4	5	6	7	8	9	10	11	12
k	**0.89**	**0.59**	**0.49**	**0.43**	**0.39**	**0.37**	**0.35**	**0.34**	**0.32**	**0.32**	**0.31**

2. A given analytical test was performed five times. The results of the analysis are represented by the following values: 6.738, 6.738, 6.737, 6.739, and 6.738%. Would you say that these results are precise? Can you say that they are accurate? **[2 marks]**

3. Predict the molarity and the normality of the following:

i. The molarity of a solution prepared by diluting 10.00 mL of a 4.281*M* solution to 50.00 mL **[3 marks]**

ii. The molarity of a solution of NaOH that has 0.491 g dissolved in 400.0 mL of solution? **[3 marks]**

iii. The normality of a solution of sulfuric acid if it is used as in the below following and there are 0.248mol dissolved in 250.0 mL of solution? **[3marks]** $\mathbf{H_2SO_4 + 2NaOH \rightarrow Na_2SO4 + 2H_2O}$

iv. What is the corresponding normality of 1M H_2SO_4 **[2 marks]**