UNIVERSITY OF AGRICULTURE ABEOKUTA
UNIVERSITY EXAMINATIONS
2009/2010
B.Sc. Degree Examination
MTS 201 (Mathematical Foundations)
2nd July, 2010 - 2.30 p.m. - 5.30 p.m.

Instructions: Full marks will be given for complete and legible answers to **THREE QUESTIONS.**

1(a) (i) Evaluate the following integrals

$$\int \frac{\sin \sqrt{x}}{\sqrt{x}} dx; \quad \int \frac{dx}{5 + 13 \cos x}$$

(ii) Find x in terms of t if $\frac{dx}{dt} = 3t^2 - 6t + 2$ and $x = 7$ when $t = 0$.

1(b)(i) The slope of a curve at any point (x, y) is equal to $\sin x$ and the curve passes through the point $(0, 2)$. Find its equation.

(ii) Using the method of integration by parts, evaluate the following integrals $\int x^2 e^{ax} dx; \quad \int e^x \sin x dx$

2(a)(i) Find the area contained between the two parabolas $4y = x^2$ and $4x = y^2$

(ii) Find the Arithmetic Progression whose sum and product of its first three terms are 27 and 504 respectively.

b(i) If the first three terms of a Geometric Progression are $1, \sin y$ and $\cos^2 y$, find its common ratio.

(ii) The first two terms of a Harmonic Progression are 2 and $\frac{4}{3}$; find the 5th and the n-th term

3a(i) Find S_n if $u_r = r^3$; $u_r = r^2$ and $u_r = r$ respectively and then evaluate $\sum_1^n (2r^3 + 3r^2 - r)$

(ii) For what values of x is the power series

$$1 + x + \frac{x^2}{2!} + \cdots + \frac{x^r}{r!} \cdots$$

convergent.

3(b)(i) Write down the equation of the line which makes an angle 150^0 with the x-axis and an intercept of -3 units on the y-axis.

(ii) Determine the equation of the circle center $(4, -7)$ which touches the line $3x + 4y - 9 = 0$.

4(a) Find (i) the eccentricity, (ii) the coordinates of the foci (iii) the equations of the directrices of the ellipse $\frac{x^2}{25} + \frac{y^2}{81} = 1$

4(b)(i) Evaluate the following double integral

4(b)(ii) If the acceleration of a particle is constant and equal to $5m/sec$ what is its speed?

5(a)(i) Write down the transpose of the matrix

$$A = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 01 & \\ -6 & -11 & -6 \end{pmatrix}$$

(ii) Determine its eigenvalues

5(b) Write down the following system of equations in matrix form and solve the system:

$$\begin{aligned} x_1 - x_2 + x_3 &= 6 \\ 3x_1 + 2x_2 - x_3 &= 14 \\ 2x_1 - x_2 + 3x3 &= 12 \end{aligned}$$

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