

GREAT ZIMBABWE UNIVERSITY

HCS 123

GARY MAGADZIRE SCHOOL OF NATURAL SCIENCES

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

BSc HONOURS IN COMPUTER SCIENCE: PART 1 SEMESTER 1

EXAMINATION: ASSIGNMENT II

HCS123: DISCRETE MATHEMATICS

DATE: 30 July 2021

Time : OF YOUR CHOICE hours

Candidates may attempt **ALL** questions : 90 MARKS

A1. (a) (i) Given that

$$A = \begin{pmatrix} 1 & -2 & 4 \\ -4 & 0 & 3 \\ 2 & -1 & 0 \end{pmatrix},$$

find the inverse of A.

[7]

(ii) Solve the linear system of equations,

$$x_1 + 2x_2 - 3x_4 + x_5 = 2,$$

$$x_1 + 2x_2 + x_3 - 3x_4 + x_5 + 2x_6 = 3,$$

$$x_1 + 2x_2 - 3x_4 + 2x_5 + x_6 = 4,$$

$$3x_1 + 6x_2 + x_3 - 9x_4 + 4x_5 + 3x_6 = 9,$$

by Gauss-Jordan reduction method or otherwise.

[7]

(b) Solve the following,

(i) differential equation,

$$\frac{dy}{dx} = \frac{ye^{xy} \cos y}{(2 + e^{xy} \sin y - xe^{xy} \cos y)}.$$
[7]

(ii) equation,

$$2x \frac{dy}{dx} + y = x^2 y^4.$$
[7]

(c) Solve the following differential equations.

(i)

$$\frac{dy}{dx} = x(1 + y^2).$$
[3]

(ii)

$$\frac{dx}{dt} + x = 2xt.$$
[3]

(iii)

$$\frac{dy}{dx} - \frac{2}{x}y = x^3 y^3, \quad \text{subject to } y(0) = 1.$$
[10]

A2.

Solve the following differential equation.

(i)

$$x \frac{dy}{dx} + y = \sin x,$$
[3]

(ii)

$$\frac{dy}{dx} = \frac{3x^3 y^2 - x^3}{2x + 1};$$
[5]

given that $x = \frac{1}{2}$ when $y = -1$.

(a) Find the general solutions of the following differential equations :

(i)

$$t^2 \frac{dy}{dt} = yt - yt^2.$$

[4]

(ii)

$$\frac{dy}{dx} = \frac{1 - x - y}{x + y}.$$

[8]

A3. (a) Use row operations to find the inverse of

$$\begin{pmatrix} 1 & 2 & 1 \\ 1 & 3 & 2 \\ 1 & 0 & 1 \end{pmatrix}.$$

[10]

(b) Given that

$$A = \begin{pmatrix} 2 & 4 & 2 \\ 1 & 3 & 2 \\ 1 & 0 & 1 \end{pmatrix},$$

find a matrix B which is row equivalent to A .

[6]

(c) Reduce

$$B = \begin{pmatrix} 1 & 2 & -3 & 4 \\ -4 & 2 & 1 & 3 \\ 3 & 0 & 0 & -3 \\ 2 & 0 & -2 & 3 \end{pmatrix} \text{ to echelon form and hence determine } |B|. \quad [10]$$

END OF QUESTION PAPER