UGANDA MARTYRS UNIVERSITY

UNIVERSITY EXAMINATIONS

FACULTY OF SCIENCE

DEPARTMENT OF NATURAL SCIENCES

END OF SEMESTER FINAL ASSESSMENT

SEMESTER I 2023/24

FIRST YEAR EXAMINATIONS FOR BACHELOR OF SCIENCE IN

INFORMATION TECHNOLOGY

(BSc IT YEAR I MASAKA CAMPUS)

COMPUTATIONAL MATHEMATICS

MTH 3206

DATE :THURSDAY 14th Dec. 2023

TIME : 9:30 AM - 12:30 PM

TIME :   3 Hours

Instructions

1. *Carefully read through ALL the questions before attempting.*

2. *ANSWER FOUR (4)Questions (All questions carry equal marks).*

3. *No **names** should be written anywhere on the examination booklet.*

4. *Ensure that your **Reg.** number and **Course** are indicated on all pages of your work.*

5. *Ensure that your work is **clear** and **readable**. Untidy work will be penalized.*

6. *Any type of examination Malpractice will lead to automatic disqualification.*

QUESTION ONE

(a) Given the complex numbers $Z = 4 + 8i$ and $W = -6 - 5i$ find

    (i) $Z + W$ [2 Marks]

    (ii) $2W - Z$.   [5 Marks]

(b) If $f(x) = 5 + x$ and $h(x) = x^2 - 3$ determine

    (i) $f(3)$ [2 Marks]

    (ii) $fh(x)$ [3 Marks]

(c)   (i) Sketch the graph of $f(x) = x^2 + 2$.   [3 Marks]

    (ii) Given that $f(x) = 2x^2 + bx + 1$ and $f(2) = 17$, determine the value of b hence

    find $f(2)$ [3 Marks]

    (iii) Given that $h(x) = 5 \log x + 2e^x$ determine the value of $h(1)$.   [4 Marks]

(d) Given that $h(x) = 4x + 8$ find

    (i) $h^{-1}(x)$ [3 Marks]

    (ii) $h^{-1}(12)$.   [3 Marks]

QUESTION TWO

(a) Given that $M = \{1, 2, 3, 4....\}$ and $N = \{1, 2, 3, 4\}$

    (i) Give a rule that describes M.   [2 Marks]

    (ii) Find $M - N$ and $N' \cap M$. Comment on both answers.   [4 Marks]

(b) Let $A = \{p, q, r\}$ and $B = \{s, t\}$

    (i) List the power set of A.   [3 Marks]

    (ii) State the cardinality of B.   [1 Mark]

    (iii) Find $(A \times B)$ [3 Marks]

(c) Given that there are 54 students in IT class. 28 of these do Architecture , 30 do C++ and 4 do neither of the programming courses.

    (i) How many of the students do both courses?   28+30   [3 Marks]

    (ii) How many of the students do C++ only?   [3 Marks]

    (iii) How many of the students do either?   [2 Marks]

    (iv) What is the probability that a student selected at random does at least one of the courses?   [2 Marks]

QUESTION THREE

(a) Give the difference between simple and compound propositions.   [1 Mark]

(b) Let $r : x$ is a prime number.

    $t : y$ is a factor of w.

    Write down the English translations for

    (i) $\sim r$ [2 Marks]

    (ii) $r \wedge t$ [2 Marks]

    (iii) $r \vee t$ [2 Marks]

    (iv) $r \longrightarrow t$.   [2 Marks]

(c) Symbolically write the following propositions

    (i) I hate politics and I enjoy football.   [2 Marks]

    (ii) If God is love then He is blind.   [2 Marks]

(d) Construct truth tables for

    (i) Conjunction   [1 Mark]

    (ii) Disjunction.   [1 Mark]

(e) (i) Define a tautology.   [1 Mark]

    (ii) Check whether the compound statement $(p \wedge q) \longrightarrow (p \vee q)$ is a tautology.   [3 Marks]

(f) Construct the truth table for the compound proposition

    (i) $[q \wedge (p \to q)] \leftrightarrow p$ [3 Marks]

    (ii) $[p \wedge (p \to \sim q)] \to \sim q$.   [3 Marks]

QUESTION FOUR

(a) Solve

    (i) $5(t + 3) = 5 - 8t$ [2 Marks]

    (ii) $2x^2 + 5x + 3 = 0$ [3 Marks]

    (iii) the simultaneous equations

$$y + 2x = 9$$
$$3x - 2y = 10$$

                    [3 Marks]

(b)   (i) Define a triangular matrix.   [2 Marks]

    (ii) Find the transpose of the matrix

$$A = \begin{pmatrix} 1 & 3 & 0 & 0 \\ 2 & 4 & 6 & 0 \\ 0 & -4 & 5 & 10 \end{pmatrix}.$$

                    [2 Marks]

(c) Given $B = \begin{pmatrix} -1 & 5 \\ 2 & 3 \end{pmatrix}$ and $D = \begin{pmatrix} 2 & -3 \\ 1 & 4 \end{pmatrix}$ determine

    (i) $D + B$ [2 Marks]

    (ii) B^2 [3 Marks]

    (iii) D^{-1} the inverse of D.   [3 Marks]

(d) Find the determinant of

(i) $\begin{pmatrix} 3 & -2 \\ 1 & 2 \end{pmatrix}$ [2 Marks]

(ii) $\begin{pmatrix} 3 & 2 & 1 \\ 2 & 0 & 2 \\ 4 & 1 & 0 \end{pmatrix}$ [3 Marks]

QUESTION FIVE,

(a) Convert

   (i) 11100011 from Binary to decimal. [2 Marks]

   (ii) 231 from decimal to Binary. [2 Marks]

   (ii) 1AC from Hexadecimal to decimal. [3 Marks]

(b) Differentiate with respect to the independent variable x

   (i) $y = x^4 + 5x$ [2 Marks]

   (ii) $y = 3x(x^2 + 12)$ [3 Marks]

(c) Find

   (i) $\int 4x^3 - 3x^2 - 2x + 12 \ dx$ [3 Marks]

   (ii) $\int_1^2 3x^2 + 4 \ dx$ [4 Marks]

(d) If $f(x) = x^2(3 - 2x)$ find the

   (i) value of $f(x)$ when $x = 2$, [2 Marks]

   (ii) gradient function $f'(x)$ [2 Marks]

   (iii) slope for the graph of $f(x)$ at the point where the x coordinate is 2. [2 Marks]

End