TECHNICAL UNIVERSITY OF MOMBASA

Faculty of applied and Health Sciences

DEPARTMENT OF MATHEMATICS AND PHYSICS

UNIVERSITY EXAMINATION FOR:

BACHELOR OF MATHEMATICS AND COMPUTER SCIENCE

AMA 4103: DISCRETE MATHS

END OF SEMESTER EXAMINATION

SERIES: MAY 2016

TIME: 2 HOURS

DATE: 2016

PAPER B

Instructions to Candidates

You should have the following for this examination

-*Answer Booklet, examination pass and student ID*

This paper consists of 5 questions. Question one is compulsory. Answer any other two questions

Do not write on the question paper.

SECTION ONE(30 marks)

QUESTION ONE

(a) Define the following notions (i) quantify (ii) connective (iii) power set (iv) cardinality

(v) idempotent. (5mks)

(b) Evaluate $^{6}C_{3}$. (2mks)

(c) If A, B and C are any three sets, prove that

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ (2 marks)

(d) Prove that √2 is an irrational number. (3 marks)

(e) Prove that if n^2 is not divisible by 5, then n is not divisible by 5. (3mks)

(f) Prove that if n is an integer then n^2 is odd if and only if n is odd. (4mks)

(g)Prove that 3x – 2 is a factor of $3x^3 - 2x^2 + 3x - 2$. (3mks)

(h) Express the following in factorial notation:

(i)(52 x 51 x 50) / (3 x 2 x 1) (ii) n (n- 1)/(2 x 1) (iii) n(n – 1)………(n – r + 1) (4marks)

(i) Determine the truth table for $(p \vee \square\, q) \wedge \square\, p$. (4mks)

SECTION TWO

QUESTION TWO (20 MARKS)

(a) Let $U = \{1, 2, 3.........20\}, \mathrm{A} = \{n \in U : 1 \le n < 10\}, B = \{n \in U : n\ is\ a\ multible\ of\ 4\}$ .Find

(a) AUB (2mks)

(b) $A \cap B$ (2mks)

(c) $(\mathrm{A}^c \cup \mathrm{B})^c$ (3mks)

b. Suppose $\mathrm{A} = \{g, f\}$. Find the power set of A. (3mks)

(c)For any two sets , show that $\mathrm{A} \cap \mathrm{B} \subseteq \mathrm{A}$. (4mks)

c. If the expression ax^4 + bx^3 – x^2 + 2x + 3 has remainder 3x + 5 when it is divided by x^2 – x – 2, find the values of a and b. (6 marks)

QUESTION THREE (20MARKS)

(3)(a)Test the validity of the following argument " If I could swim I would come sailing with you. I can not swim so iam not coming sailing with you. (7mks)

(b)Prove that if m and n are positive integers such that m is a factor of n and n is Factor of m then m=n. (4mks)

(c)Prove that there are infinitely many prime numbers. (6mks)

(d) Evaluate ${}^7C_2$. (3mks)

QUESTION FOUR (20 MARKS)

(4)(a) Let $f : \square \to \square$ *and* $g : \square \to \square$ be functions defined by $f(x) = \dfrac{2x+3}{5}$ *and* $g(x) = \dfrac{3}{4-x}$

Find (i) $f^{-1}(x)$ *and* $g^{-1}(x)$ (3mks)

(ii) $(g \circ f)^{-1}$ (3mks)

(iii) Show that $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$ (4mks)

(b) Use the binomial theorem to find the value of $(1.03)^{1/3}$, to 4 decimal places. (5 marks)

(c) Show that $\neg p \wedge \neg q$ *is logically equivalent to* $\neg(p \vee q)$ (5 mks)

QUESTION FIVE

5(a) Each of the100 students in the first year at Technicaluniversity computer science study atleast one of the elective subjects maths, electronics and accounting. Given that 65 study maths, 45 study electronics, 42 study accounting, 20 study maths and electronics,25 study maths and accounting and 15 study electronics and accounting. Find the number of students who study.

(i) All three elective subjects. (4mks)

(ii) Maths and electronics but not accounting. (3mks)

(iii) Only electronics as an elective subject. (3mks)

(b) Let B bea Boolean algebra, show that $\forall\, a \in \mathrm{B}$,(i) $a \bullet a = a$. (4mks)

(ii) $a + a = a$. (3mks)

(c) State three type of graphs that we use in computer science. (3mks)