BABCOCK UNIVERSITY

SCHOOL OF SCIENCE & TECHNOLOGY

DEPARTMENT OF BASIC SCIENCES

FIRST SEMESTER EXAMINATION, 2018/2019

COURSE CODE: MATH 101 **COURSE TITLE:** GENERAL MATHEMATICS 1

CREDIT UNITS: 3 **TOTAL MARKS:** 60 **TIME ALLOWED:** 2 HOURS

INSTRUCTION: Attempt any **FOUR** questions

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QUESTION 1

a) (i) If A and B be two non- empty sets, then the define the notion "$A \cup B$" (1 mark). Hence, use the anti-symmetric law to show that $A \cup B = B \cup A$ (3 marks)

(ii) If $\mu = \{1,2,3,4,5,6,7,8,9,10\}$ and $A \subset \mu$, where $A = \{2,4,6,8,10\}$. Show that $(A')' = A$ ($2\frac{1}{2}$ marks)

b) (i) What is a Venn diagram? (1 mark)

(ii) In a MATH 101 tutorial class of 30 students, 17 students study Mathematics, 15 students study Physics Electronics. Show the information clearly in a Venn diagram (2 marks). Hence, find out how many students study;

(i) Both Mathematics and Physics Electronics (1 mark)
(ii) Mathematics only (1 mark) (iii) Physics Electronics only (1 mark)

c) Say True or False for each of the following sentences

(i) $(\mathbb{R}, +)$ is closed ($\frac{1}{2}$ marks) (ii) $(\mathbb{R}, -)$ is closed ($\frac{1}{2}$ marks)

(iii) $(\mathbb{N}, -)$ is closed ($\frac{1}{2}$ mark)

(iv) 0 is the identity element with respect to addition in $\mathbb{R}$ ($\frac{1}{2}$ mark)

(v) 1 is the identity element with respect to multiplication in $\mathbb{R}$ ($\frac{1}{2}$ mark)

QUESTION 2

a) Find the values of the constant k for which the equation $(3k + 1)x^2 + (k + 2)x + 1 = 0$ has equal roots (3 marks)

b) Let α and β be the roots of $5x^2 - 3x - 1 = 0$, find the values of ;

(i) $\alpha^3 - \beta^3$ (4 marks), and form the quadratic equations whose roots are;

(ii) $\frac{1}{\alpha^2} + \frac{1}{\beta^2}$ (4 marks) (iii) $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$ (4 marks)

QUESTION 3

a) Simplify the following (i) $\frac{n!}{(n-2)!}$ (ii) $\frac{(n-1)!}{(n+1)!}$ (4 marks)

b) Show that $nc_r = nc_{n-r}$ (3 marks)

c) Expand $(2y + x)^4$ in ascending powers of x. Hence, use your expansion to evaluate $(2.01)^4$ to 4 significant figures (8 marks)

QUESTION 4

a) Define Sequence and Series. (4 marks)

b) Given a progression 2,4,6,8,10,12,...Find the 22nd term and the sum of the first 40 terms. (4 marks)

c) In a Geometric Progression, the first term is 7, the last term is 448 and the sum is 889. Find the common ratio. (7 marks)

QUESTION 5

a) State the principle of Mathematical Induction. (2 marks)

b) Prove by induction that the followings are valid for all positive integer n ;

(i) $5 + 10 + 15 + 20 + 25 + \cdots 5n = \frac{5n(n+1)}{2}$ ($4\frac{1}{2}$ marks)

(ii) $\sum_{r=1}^{n}(4r - 1) = n(2n + 1)$ ($4\frac{1}{2}$ marks)

(iii) $10^n - 1$ is a multiple of 9 (4 marks)

QUESTION 6

a) (i) Differentiate between Equality of Sets and Equivalence of Sets (2 marks)

(ii) If E and F are two arbitrary non empty finite sets, then show that $n(E \cup F) = n(E) + n(F) - n(E \cap F)$ ($5\frac{1}{2}$ marks)

b) If b-15, 10, b are in a G.P. Find the possible values of b. (3 marks)

c) The sum of the n terms of an Arithmetic progression is $2n^2 - n$. Find the nth term and show that the progression is an A.P. ($4\frac{1}{2}$ $marks$)