JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL, PHYSICAL, MATHEMATICS AND ACTUARIAL SCIENCES

UNIVERSITY EXAMINATION FOR DEGREE OF BED/BSC

2ND YEAR 2ND SEMESTER 2022/2023 ACADEMIC YEAR

MAIN REGULAR

COURSE CODE: WMB 9208

COURSE TITLE: INTRODUCTION TO ANALYSIS

EXAM VENUE: **STREAM: (BED/BSC)**

DATE: **EXAM SESSION:**

TIME: 2.00HRS

Instructions:

1. **Answer Question one (COMPULSORY) any other TWO questions only**
2. **Candidates are advised not to write on the question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

QUESTION ONE [30 MARKS] (COMPULSORY)
(a). Prove that the interior of an open set is open. (5 marks)
(b). Prove that no rational number x satisfies the equation $x^3=x+7$. (5 marks)
(c). Explain maximal and minimal attainability of a continuous function f. (5 marks)
(d). Geometrically describe the asymptotic discontinuity of a function. (5 marks)
(e). Giving relevant examples, describe limit inferior and limit superior. (5 marks)
(f). Given that $f(x)=3x^2-7x+4$ and $g(x)=3x-1$ find $g^{-1}(x)-5f(x)$. (5 marks)

QUESTION TWO (20 MARKS)
(a). Prove that every positive integer is either odd or even. (7 marks)
(b). State and prove the Binomial Theorem by mathematical induction. (13 marks)

QUESTION THREE (20 MARKS)
(a). Prove that if $a_1, a_2,..., a_n,..$ is a sequence of numbers, with $a_1=1$ and if the relation
$a_{n+1}=2a_n+1$ holds, for all positive whole numbers n, then $a_n=2^n-1$. (5 marks)
(b). Mathematical analysis is indispensable in the daily running of activities in the world. Trace the origin of mathematical analysis, describe its importance and illustrate how it controls the world in terms of medicine, sports, elections, agriculture, politics, engineering among other aspects. (15 marks)

QUESTION FOUR (20 MARKS)
(a). Define Boolean algebra and hence show that the set $\{0,1\}$ is a Boolean algebra. Describe how this set is useful in analysis of computing techniques. (10 marks)
(b). Show that every bounded sequence has a limit point. (10 marks)

QUESTION FIVE (20 MARKS)
(a). Define: Subset; Disjoint sets; Range of a function. (6 marks)
(b). A research conducted on the eating habits among 400 people gave the following data in respect of three types of food:

Chapati...150
Beans.. 100
Rice..120
Chapati and Beans..............................40
Chapati and Rice.................................50
Beans and Rice...................................45
Eat all the three types of food..............21

(i). Present the above information on a Venn diagram. (5 marks)
(ii). Find the total number of students who eat at least two types of food. (3 marks)
(iii). Find the total number of students who eat two types of food only. (2 marks)
(iv). Find the total number of students who prefer one type of food only. (2 marks)
(v). Find the total number of students who prefer none of the 3 types of food. (2 marks)