110

(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

UNIVERSITY EXAMINATIONS 2022/2023 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER EXAMINATIONS MAIN EXAM

FOR THE DEGREE OF BACHELOR SCIENCE IN MEDICAL LABORATORY

COURSE CODE: **BML 114**

COURSE TITLE: **MATHEMATICS FOR BIOMEDICAL SCIENCES**

DATE: 25th April, 2023 **TIME: 8.00-10.00 AM**

INSTRUCTIONS TO CANDIDATES

Answer all the questions in Section A and any other TWO in section B

This Paper Consists of 6 Printed Pages. Please Turn Over.

SECTION A (20 MARKS) Answer all the questions

QUESTION ONE (20 MARKS)

a) State the mean value theorem (2 Marks)

b) Find the limit $\lim_{x\to\infty}\frac{2x^3-1}{x^3+x+1}$ (2 Marks)

c) The electromotive force E of a particular electrical circuit is given by $E=3\sin 2t$ where E is measured in volts and t in seconds. Find the average value of E as t ranges from 0 to 0.5 seconds (4 Marks)

d) Given $x^2+y^2=40$, find y'' (4 Marks)

e) Find the open intervals on which $f(x)=x^2-\frac{3}{2}x^2$ is increasing or decreasing (4 Marks)

f) Find the derivative of $h(x)=(3x-2x^2)(5-4x)$ (3 Marks)

QUESTION TWO (20 MARKS)

a) Find the domain and the range of the function $f(x)=\sqrt{x^2-x-6}$ (3 Marks)

b) Find $\frac{dy}{dx}$ given that $y^3+y^2-5y-x^2=-4$ (4 Marks)

c) Evaluate $\int\frac{2x}{(x+1)^2}dx$ (4 Marks)

d) Determine the open intervals in which the graph of $f(x)=\frac{x^2+1}{x^2-4}$ is concave upward or downward (5 Marks)

e) Find the arc length of the graph of $y=\frac{x^3}{6}+\frac{1}{2x}$ on the interval [0.5, 2] (4 Marks)

QUESTION THREE (20 MARKS)

a) Differentiate between odd and even function (2 Marks)

a) Differentiate between definite and indefinite integrals (2 Marks)

b) Evaluate $\int x(x^2+1)^2dx$ (5 Marks)

c) Find the volume of the solid formed by revolving the region bounded by the graphs of $y=x^2+1, y=0, x=0$ and $x=1$ about y-axis (6 Marks)

d) Find the area of the region bounded by the graphs of $y=x^2+2, y=-x, x=0$ and $x=1$ (5 Marks)

1. If f(x) = | x | , then for interval [-1, 1] ,f(x)

   A. satisfied all the conditions of Rolle's Theorem

   B. satisfied all the conditions of Mean Value Theorem

   C. does not satisfy the -conditions of Mean Value Theorem

   D. None of these

2. The value of the improper integral

$$\int_0^1 xlnx$$

   A. ¼
   B. 0
   C. -1/4
   D. 1

3. What is the derivative of f(x) = | x | at x = 0

   A. 1
   B. -1
   C. 0
   D. Does not exist

4. Which of the following is correct ?

   A. f(a) is an extreme value of f(x) if f '(a)=0

   B. If f(a) is an extreme value of f(x), then f '(a) = 0

   C. If f '(a) = 0, then f (a) is an extreme value of f(x)

   D. all of these

5. Which of the following methods is a form of graphical presentation of data?
   A. Line Diagram
   B. Pie diagram
   C. Bar diagram
   D. Histogram

6. All the following are measures of central tendency, except:
   A. Mode
   B. Variance
   C. Mean
   D. Median

7. Large standard deviations suggest that:
   A. scores are probably widely scattered.
   B. there is very little deference among scores.
   C. mean, median and mode are the same
   D. the scores not normally distributed.

8. A statistic which describes the interval of scores bounded by the 25th and 75th percentile ranks is:

A. Inter quartile range
B. Confidence Interval
C. Standard deviation
D. Variance

9. A measure of dispersion of a set of observations in which it is calculated by the difference between the highest and lowest values produced is called:
   A. Standard deviation
   B. Variance
   C. Range
   D. Mode

10. Find the value of $\lim_{x\to\infty} \frac{x+2}{9x^2+1}$
    A. 0
    B. 0.111
    C. 0.222
    D. ∞

11. Find an equation of the tangent line to the curve $y = 2x\sin x$ at the point $(0.5\pi, \pi)$
    A. $y = 2x + 2\pi$
    B. $y = 2x$
    C. $y = -2x + 2\pi$
    D. $y = -2x$

12. Integrate (1 / (3x + 4)) with respect to x and evaluate the result from x = 0 and x = 2.
    A. 0.278
    B. 0.336
    C. 0.252
    D. 0.305

13. Integrate the square root of (1 – cos x) dx.
    A. -2√2 cos (x/2) + C
    B. -2√2 cos x + C
    C. 2√2 cos (x/2) + C
    D. 2√2 cos x + C

14. Given the function $f(x) = x^3 - 4x^2 + 5x$, find the open interval(s) where f is concave down, i.e where the second derivative $f''(x) < 0$
    A. $\left(\frac{4}{3}, +\infty\right)$
    B. $\left(-\infty, \frac{4}{3}\right)$

C. $\left(-\infty, \frac{4}{3}\right)$

D. $\left[\frac{4}{3}, +\infty\right)$

15. The definition of the first derivative of a function $f(x)$ is

A. $f'(x) = \frac{f(x+\Delta x)+f(x)}{\Delta x}$

B. $f'(x) = \frac{f(x+\Delta x)-f(x)}{\Delta x}$

C. $f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x)+f(x)}{\Delta x}$

D. $f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x)-f(x)}{\Delta x}$

16. Let $f(x) = 2.5x^2 - e^x$. Find the value of x for which the second derivative $f''(x)$ equals zero

A. In 5 B. 5e C. 0 D. e^5

17. Use implicit differentiation to find an equation of the tangent line to the curve $\sin x + \cos y = 1$ at the point $(\pi/2, \pi/2)$

A. $y - \pi/2 = 4(x - \pi/2)$

B. $y = \pi$

C. $y - \pi/2 = (x - \pi/2)$

D. $y = \pi/2$

18. The value of the integral $\int_0^{100\pi} \sin x dx$ is equal to

A. 100 B. 1 C. 200 D. 100π

19. The area bounded by the curves $y^2 = x - 1$, $2y = x$ x-axis and y-axis will be equal to

A. 4.5 square units

B. 0.8 square units

C. 0.333 square units

D. 2 square units

20. Find the exact value of $\lim_{x \to 0} \frac{\sqrt{3+x} - \sqrt{3}}{x}$

A. $\sqrt{3}$

B. 0

C. $\frac{1}{2\sqrt{3}}$

D. The limit does not exist

SECTION B (20 MARKS) ANSWER ANY TWO QUESTIONS

QUESTION FOUR (20 MARKS)

a) Define the following terms: (3 Marks)

(i) Statistics

(ii) Average

b) In a class of 50 students, 10 have failed and their average marks is 2.5. The total marks secured by the entire class are 281. Find the average marks of those who have passed? (4 Marks)

c) State any four characteristics of a good measure of central tendency. (3 Marks)

d) The mean monthly salary paid to 1000 employees of a hospital was Kshs. 5000. The mean monthly salary paid to male and female employees were Kshs. 5200 and Kshs. 4200 respectively. Determine the % of males and females employed by the hospital. (3 marks)

e) Two brands of drugs are tested with the following results

	NUMBER OF BRANDS	
Mean shell life	X	Y
20-25	1	0
25-30	22	24
30-35	64	76
35-40	10	0
40-45	3	0

(i) Which brand of drugs has greater average life? (3 marks)

(ii) Compare the variability and state which brands of drug is suitable for use (4 marks)