MACHAKOS UNIVERSITY

University Examinations for 2024/2025 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES
DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER EXAMINATION FOR DEGREE IN BACHELOR OF SCIENCE IN PUBLIC HEALTH

HPH 100: APPLIED TECHNICAL MATHEMATICS

DATE: 17TH JANUARY, 2025 **TIME: 8.30 AM – 10.30 AM**

INSTRUCTIONS:
*Answer question **ONE (Compulsory)** and **any other TWO** questions*

QUESTION ONE (30 MARKS)

a) Find the derivative of the function $y=(2x+3)^5$ (3 marks)

b) Evaluate $\int e^{2x+1}dx$ (2 marks)

c) Distinguish between set union and set intersection. (2 marks)

d) Solve the equation $9^{a-3} \times 81^{1-a} = 27^{-a}$ (4 marks)

e) Solve the equation $\log(x-1) + \log(x+1) = 2\log(x+2)$. (4 marks)

f) The sum of the first eight terms of an arithmetic progression is 220.If the third term is17, find the sum of the first six terms. (5 marks)

g) Expand $(1+x)^9$ up to the termx^3, use the expansion to estimate $(0.98)^9$ *c*orrect to 3 decimal places. (5marks)

h) Solve the complex equation $(x-i2y)+(y-i3x)=2+i3$ (5marks).

QUESTION TWO (20 MARKS)

a) The sum of the fourth and the sixth terms of a GP is 80. If the product of the third and the fifth term is 256.determine;
   i. The common ratio (3marks)
   ii. The first term. (3marks)
   iii. Sum of the first eight terms (3marks)

b) In a class 60 students 38 take geography while 34 take business, determine how many students take both subjects. (5marks)

c) Use the binomial theorem to determine the first three terms of the expansion $(25-x)^{1/2}$ .Hence calculate the value of $\sqrt{24}$ correct to 3 decimal places. (6marks)

QUESTION THREE (20 MARKS)

a) Solve the equation $5(3^{2x})+6=31(3^{x})$ (5marks)

b) Determine the modulus and the argument of the complex number $Z=2+3i$ and Express z in polar form. (5marks)

c) Solve the equation $log_3 x-4log_x 3+3=0$. (5marks)

d) Find the coefficient of x^{10} in the expansion of $(2x-3)^{14}$ (5marks)

QUESTION FOUR (20 MARKS)

a) Differentiate $y=\frac{sin^3 x}{x}$ (3marks)

b) Find the turning points of the function $y=x^3-6x^2+9x-2$, distinguish between them. (5marks)

c) The displacement of particle S, meters covered by a moving particle after *t* seconds is given by $S=2t^3+4t^2-8t+3$
   Find i) Its velocity at *t=2* and *t=3* (4marks)
   ii) The instant at which the particle is at rest. (3marks)

d) Find the area enclosed between the curve $y=4x(x-1)(x-2$ and the x axis. (5marks)

QUESTION FIVE (20 MARKS)

a) Find the range of the following functions. State whether the function is one-to-one or many-to-one.
   i) $f:x\rightarrow x+3$,with the domain $(0\leq x\leq 4)$ (5marks)
   ii) $f:x\rightarrow\sqrt{x}$; With the domain$(0\leq x\leq 25)$, (4marks)

b) A function f is defined as $f:x\rightarrow\frac{x+5}{x-6}$. Find$f^{-1}(3)$ (5marks)

c) If $f(x)=2x$ *and* $g(x)=3x+1$ .Find $fg(2)$ and $gf(6)$ (6marks)