MANICALAND STATE UNIVERSITY OF APPLIED SCIENCES

FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND MINERAL PROCESSING ENGINEERING
DEPARTMENT OF CHEMICAL AND PROCESSING ENGINEERING

MODULE: ENGINEERING MATHEMATICS I

CODE: ENGT 102

SESSIONAL EXAMINATIONS

JUNE 2023

DURATION: 3 HOURS

EXAMINER: NYAKUAMBA T

INSTRUCTIONS

1. *Answer **All** in Section A*
2. *Answer **three** questions in Section B.*
3. *Start a new question on a fresh page*
4. *Total marks 100*

Additional material(s): *Non-programmable electronic scientific calculator.*

SECTION A (40 marks)

Answer ALL Questions

A1. a) Does the decimal number 0.12345678910111213141516171819… represents a rational or an irrational number? Give a reason for your answer [3]

b) For what values of x is each of the following functions continuous

(i) $f(x) = \frac{x^2}{x^2-1}$ [2]

(ii) $f(x) = \frac{1+cosx}{3+sinx}$ [1]

(iii) $f(x) = \frac{x-|x|}{x}$ [2]

A2 Let $f(x) = \begin{cases} \frac{|x-3|}{x-3} & ; x \neq 3 \\ 0 \; ; x = 3 \end{cases}$

(a) Graph the function $f(x)$ [3]

(b) Find the $\lim_{x \to 3^+} f(x)$ [2]

(c) Find the $\lim_{x \to 3^-} f(x)$ [2]

(d) Find the $\lim_{x \to 3} f(x)$ [1]

A3. IF X= -4, y=10, z=3

P=2/3, q=5/4 and r=-4/5

(a) Evaluate: (i) (x+y)+z

(ii) x+(y+z) [2]

(b) .Evaluate (i) (pq)r

(ii) p(qr) [2]

(c). which law is illustrated by the two questions a and b above [2]

(d).You are told that π=22/7 is this true or false. Give reason for your answer [2]

A4. Differentiate the following functions with respect to x

(i) $f(x) = x^2 - \frac{1}{\sqrt{x}} + lnx$ [2]

(ii) $x^2 - xy + y^2 = 0$ [3]

(iii) $x = cos2t; \quad y = sin2t$ [3]

A5). Find the set of valves of x for which the following set of inequalities hold

(a)$|x + 2| \geq |x - 3|$ [4]

(b) $\frac{2}{7x} - 1 > \frac{4}{3x}$ [4]

SECTION B. (60 Marks)

Candidate may attempt three questions being careful to number them B6 to B9

B6. (i) Evaluate the following limits

a) $\lim_{n\to\infty} \frac{n^2+n}{n^3-n^2}$

b) $\lim_{n\to\infty} \frac{2n+2}{3n-5}$

c) $\lim_{n\to 0} \frac{sinx}{x}$

d) $\lim_{x\to 5} 3$

e) $\lim_{n\to\infty} (\sqrt{n+10} - \sqrt{n})$

[2,2,2,2,4]

(ii) Solve the following equations

(a)$|3 + 2x| = 2|x + 1|$ [4]

(b) $\frac{2}{7x} - \frac{4}{3x} > 1$ [4]

B7(a) Differentiate the following functions with respect to x

(i) $y = 3x^2 + 2x + 7 + e^{3x^2-3x+6}$ [4]

(ii) $x = t - \frac{1}{t}$ and $y = \frac{1}{t^2}$ [4]

(iii) $y = \frac{1}{x^2}$ [2]

b) Integrate the following functions with respect to x.

i) $\frac{Cos\ x - Sin\ x}{Sin\ x + Cos\ x}$

ii) $3e^{-3x} - \frac{1}{2}e^{2x}$

iii) $(3x + 5)^5$

iv) $Cos(6 - 7x)$ [10]

B8 a) Find the area of the bounded plane region R lying between the curves

$y = x^2 - 2x\ and\ y = 4 - x^2$ [5]

(b) Given that $x = 3(2\theta - 3Sin\ 2\theta)$ and $y = 3(1 - Cos\ 2\theta)$

Find $\frac{dy}{dx}$ [5]

(c) Find the equation of the tangent to the curve
$3x^2 - 7y^2 + 4xy - 8x = 0$ at the point$(-1,1)$. [5]

(d) (i) Define cosh x and sinhx in terms of exponentials.

(ii) Using the definition in (i) above show that

$\frac{d}{dx}\cosh(x) = \sinh(x)$ [5]

B 9. (a) Deduce the formular for the sum $\frac{1}{1.2} + \frac{1}{2.3} + \cdots + \frac{1}{n(n+1)}$ and prove it by induction [7]

(b) (i) Integrate x^2e^x with respect to x [3]

(ii) Express $\frac{2x-3}{x^2-5x+6}$ in partial fractions hence or otherwise
$\int_0^1 \frac{2x-3}{x^2-5x+6}$ dx [4, 6]

END OF QUESTION PAPER