The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical & Computer Engineering

Study Programme	: Bachelor of Software Engineering Honors
Name of the Examination	: Final Examination
Course Code and Title	**: MHZ3459 – Mathematics for Computing**
Academic Year	: 2019/2020
Date	: 26th July 2020
Time	: 1330-1630hrs
Duration	: **3 hours**

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Eight (8)** questions in **Five (5)** pages.
3. Answer any **five** out of eight questions.
4. Show all steps clearly.
5. Answer for each question should commence from a new page.
6. This is a Closed Book Test **(CBT).**
7. **Programmable** calculators are not allowed.
8. Do not use red color pen.

Q1

a) Let A, B, C and D be Boolean variables. Prove the following identities [6]

i. $AB + \overline{A}C + BC = AB + \overline{A}C$

ii. $(\overline{AB})(\overline{A} + B)(\overline{B} + B) = \overline{A}$.

iii. $\overline{A\overline{B} + B(\overline{C} + \overline{CD})} = \overline{AB} + \overline{A\overline{B}} + \overline{A}CD + BCD$

b) Using Truth Tables show the following: [4]

i. $\overline{(\overline{a} + \overline{b})(\overline{a} + b)} = a$

ii. $\overline{x + \overline{y} + z} = \overline{x}y\overline{z}$

c) Consider the following truth table. [10]

A	B	C	D	Result
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

i. Setup the Karnaugh map for the above truth table.

ii. Then find the solution and simplify using the Karnaugh map.

Q2

a) If $A = \begin{bmatrix} 1 & -1 \\ 2 & 0 \end{bmatrix}$, then show that [6]

$A^2 + 2I = A$; where I is the identity matrix of order 2.

b)

Let $A = \begin{bmatrix} -1 & 1 & -1 \\ 3 & -3 & 3 \\ 5 & -5 & 5 \end{bmatrix}$, show that $A^2 = A$ [8]

Hence, deduce that $(I - A)^2 = (I - A)$, where I is the identity matrix of order 3.

c)

Let $A = \begin{bmatrix} -5 & -8 & 0 \\ 3 & 5 & 0 \\ 1 & 2 & -1 \end{bmatrix}$

Show that $A^2 = I$, where I is the identity matrix of order 3. [6]

Q3

If $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$, then

a) Find AA^T [6]

b) Using Gaussian elimination method, find the inverse of the matrix A. [14]

Q4

a) Given that $\sin\theta = \frac{3}{8}$ and $0 < \theta < \frac{\pi}{2}$, and $Sin\ \alpha = \frac{5}{13}$ and $\frac{\pi}{2} < \alpha < \pi$. Find

i. $\sin(\theta - \alpha)$ ii. $\cos(\theta + \alpha)$ iii. $\tan(\theta - \alpha)$

[12]

b) Sketch the graph of $y = cos^2 x$, where $-2\pi \leq x \leq 2\pi$ [8]

Q5

a) Write the formula for $Sin(A + B)$

[6]

i. Using the above formula, prove that $Sin\ 3A = 3SinA - 4Sin^3A$.

ii. Hence, find the value of $Sin\ 135^0$

b) Prove the following trigonometric identities

[9]

i. $(1 - Cos^2x)(1 + Cos^2x) = 2Sin^2x - Sin^4x$

ii. $\frac{2Cos^2x}{2Cotx - Sin2x} = Tanx$

iii. $Sin75^0 + Sin15^0 = \sqrt{\frac{3}{2}}$

c) Find the general solution of the following equation [5]

$2Sin^2x - 3Sin\,x + 1 = 0$ in the range.

Q6

a) Evaluate the following limits. [6]

i. $\lim_{x \to 0} \frac{tanx - x}{sinx}$

ii. $\lim_{x \to 3} \frac{x^2 - 5x + 6}{x^2 - 2x - 3}$

iii. $\lim_{x \to 1} \frac{1 - cosx}{x^2}$

b) Differentiate the following functions with respect to x. [8]

i. $y = e^{-2x} sin2x$

ii. $y = (\frac{xsinx}{1 + cosx})$

c) Find the equation of the tangent to the curve $y = sin(3x) + 1$ at the point where $x = \frac{\pi}{3}$.

[6]

Q7

a) Using the first principles, find the first derivative of the following.

[12]

i. $y = x^2 + 3x + 2$

ii. $y = \frac{1}{1+x}$

iii. $y = sinx + 1$

iv. $y = cosx$

b) Taking $x_0 = 1$ as an initial approximation for the root of Newton-Raphson formula, obtain two further approximations to the positive root of $x^2 - 3 = 0$, giving your answers to 3 decimal places.

[8]

Q8

a) Find the following indefinite integrals.

[6]

i. $\int(sin2x - cos3x)dx$

ii. $\int \sin(1 - x)dx$

b) Evaluate the following definite integrals.

[8]

i. $\int_0^2 \frac{1}{x^2+4} dx$

ii. $\int_0^3 \frac{1}{\sqrt{9-x^2}} dx$

[6]

c)

i. Sketch the curves of the graph of $y = x^2$ and the straight line $y = x$ in the same figure.

ii. Find the coordinates of the points of intersection of the curves.

iii. Hence, find the area bounded by the two graphs $y = x^2$ and $y = x$.