RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

Bachelor of Science in Applied Sciences
SecondYear- Semester II Examination – Jan/Feb 2023

MAA 2203 – NUMERICAL ANALYSIS II

Answer **FOUR (4)** questions only. Time: **Two (2) hours**

1.

a) The following values of the function $f(x) = \sin x + \cos x$, are given

x	10°	20°	30°
$f(x)$	1.1585	1.2817	1.3660

Construct the quadratic Lagrange interpolating polynomial that fits the data. Hence ,find $f\left(\frac{\pi}{12}\right)$, and compare it with the exact value. **(50 marks)**

b) Obtain Newton's divided difference interpolating polynomial satisfying the following values:

x	4	5	7	10	11	13
$f(x)$	48	100	294	900	1210	2028

Also find $f(6), f(12)$ and the second derivative of $f(x)$ at $x = 3$. **(50 marks)**

2.Assume that $f(1.3) = 0.620086, f'(1.3) = -0.522023, f(1.6) - 0.455402, f'(1.6) = -0.569896, f(1.9) = 0.281819$,and $f'(1.9) = -0.581157$. Find the Hermite interpolating polynomial and use it to approximate the value of $f(1.5)$. **(100 marks)**

3.

a) Obtain the piecewise quadratic interpolation polynomial for the function $f(x)$defined by the given data.

X	0	1	2	3
$f(x)$	1	2	5	10

Hence, find the approximate values for $f\ (0.5), f\ (1.5)$, and $f\ (2.5)$. **(50 marks)**

b) Obtain the piecewise linear interpolating polynomial of the function $f(x)$defined by

x	1	2	4	8
$f(x)$	3	7	21	73

Hence determine the value of $f\ (3)$ and $f\ (7)$. **(50 marks)**

4.

a) Find a difference equation that expresses the relationship $y = \frac{a}{x} + b$. **(30 marks)**

b) Solve the difference equation $U_{n+3} - 2U_{n+2} - 5U_{n+1} + 6U_n = 0$. **(35 marks)**

c) Solve the difference equation $Y_{n+2} - 4Y_n = 2^n$. **(35 marks)**

5.

a) Use the midpoint rule to estimate $\int_0^1 x^2 dx$ using four subintervals. Compare the result with the actual value of this integral. **(30 marks)**

b) Use the trapezoidal rule with $n = 2$ to estimate $\int_1^2 \frac{1}{x} dx$. **(30 marks)**

c) Use Simpson's Rule with n=4 to approximate the integral $\int_0^8 \sqrt{x} dx$. **(40 marks)**

END