RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree
First Year – Semester II Examination – April / May 2015

MAA 1203 – Numerical Analysis I

Answer **Four** Questions with **Questions No:1** Time allowed: Two hours

Calculators are allowed

The Newton's Forward formula $P_k = \sum_{i=0}^{k} \binom{k}{i} \Delta^i y_0$

Stirling's formula $P_k = y_0 + \sum_{i=1}^{n} \left[\binom{k+i-1}{2i-1} \delta^{2i-1} \mu\, y_0 + \frac{k}{2i} \binom{k+i-1}{2i-1} \delta^{2i} y_0 \right]$

Bessel's formula $P_k = \sum_{i=0}^{n} \left[\binom{k+i-1}{2i} \mu\, \delta^{2i} y_{1/2} + \frac{1}{2i+1} \left(k - \frac{1}{2}\right) \binom{k+i-1}{2i} \delta^{2i+1} y_{1/2} \right]$

Newton's Backward formula

$P_k = y_0 + k\, \nabla y_0 + \frac{k(k+1)}{2!} \nabla^2 y_0 + \cdots + \frac{k-(k+n-1)}{n!} \nabla^n y_0$; where k=0,-1,...,-n

01 i Use the **Newton Raphson method** to find a root of the Equation $x^3 - 2x - 5 = 0$ (Hint: $x_0=2$) ***30 Marks***

ii Find the real root of $x^3 - x^2 - 1 = 0$ up to three decimal places using **Bisection method.** ***25 Marks***

iii Consider the special function for which $y_k = k(k-1)(k-2)$ and prove $\Delta y_k = 3k(k-1)$. ***15 Marks***

iv Convert ;
a $Y = (1001)_2$ b $Y = (0.1111.....)_2$ c $Z = (1....1)$ to base by10.
Where Z has k+1 digits. ***15 Marks***

v Define the terms absolute and relative errors. If $y = \frac{0.31x+2.73}{x+0.35}$ where the coefficients rounded off. Find the absolute and relative error in when $x = 0.5 \mp 0.1$. ***30 Marks***

vi Consider the special function $y_k = k(k-1) \ldots\ldots (k-(n-1)) = k^{(n)}$ ***25 Marks***

Prove that $\Delta k^n = nk^{n-1}$ for all integers n.

Show that $\Delta^2 y_k = n(n-1)k^{(n-2)}$ and $k^{(4)} = -6k + 11k^2 - 6k^3 + k^4$ ***20 Marks***

2. Apply Lagrange's formula to find the root of f(x)=0 when :

f(30) = -30, f(34) = -13, f(38) = 3, f(42)=18 **80 Marks**

3. Values of y= $\sqrt{x}$ are listed in the following table, which are rounded off to 5 decimal places. Fin $\sqrt{1.12}$ by using Stirling's formula

x	1.00	1.05	1.10	1.15	1.20	1.25	1.30
y	1.00000	1.02470	1.04881	1.07238	1.09544	1.11803	1.14017

80 Marks

4. i Using Bessel's formula find 3rd degree polynomial that approximates the following data:

f(0) = 2, f(1) = 3, f(2) = 8, f(3)=23. **50 Marks**

ii Find the general solution of $y_{k+2} - 2Ay_{k+1} + y_k = 0$ *(A is a constant)* **30 Marks**

5. If **f(x)** is known at the following data points

x_i	f_i
0	1
1	7
2	23
3	55
4	109

then find **f(0.5)** and **f(1.5)** using Newton's forward difference formula. **80 Marks**