THE OPEN UNIVERSITY OF SRILANKA
B.Sc/B.Ed. Degree Programme, Continuing Education Programme
OPEN BOOK TEST (OBT) - 2004/2005
LEVEL 5 – APPLIED MATHEMATICS
AMU 3183/ AME 5183- NUMERICAL METHODS II

DURATION: ONE AND HALF - HOURS

DATE: 27.08. 2005 **TIME: 4.00 P.M - 5.30 P.M**

Answer all questions.

1.(a) By considering the limit of the three point Lagrangian interpolation formula relative to x_0 , $x_0+\varepsilon$ and $x_1+\varepsilon$ as $\varepsilon \to 0$,obtain the formula

$$f(x)=\frac{(x_1-x)(x+x_1-2x_0)}{(x_1-x_0)^2}f(x_0)+\frac{(x-x_0)(x_1-x)}{(x_1-x_0)}f\ (x_0)+\frac{(x-x_0)^2}{(x_1-x_0)^2}f(x_1)+E(x).$$

where $E(x)=\frac{1}{6}(x-x_0)^2(x-x_1)f^{(3)}(c)$.

(b) The Dow Jones industrial index in 2001 is given in the following table. Find the polynomial of the lowest possible degree interpolating the data from March to May by applying Lagrange interpolation.

(c) Evaluate the polynomial to estimate the index in October. Comment on your results.

Month	January	February	March	April	May	June	July	August	September	October
Index	10600	11000	10400	9800	10800	11000	10500	10500	10000	8800

2.(a) Derive normal equations for the least squares n^{th} degree polynomial fit and deduce the normal equations for quadratic fit.

(b) Fit a curve of the form $y=a_0+a_1x+a_2x^2$ to the following data:

x:	2	3	4	5	6	7	8
y:	2.1	3.3	3.9	4.4	4.6	4.8	4.2.

3.(a) The centered difference operator δ is defined as $\delta = E^{\frac{1}{2}} - E^{-\frac{1}{2}}$. Prove the following.

(i) $\Delta = \delta E^{\frac{1}{2}}$ where Δ is the forward difference operator.

(ii) $\Delta = \frac{1}{2}\delta^2 + \delta\sqrt{1+\frac{\delta^2}{4}}$.

(iii) $E^{\frac{1}{2}} + E^{-\frac{1}{2}} = \frac{2+\Delta}{\sqrt{1+\Delta}} = \frac{2-\nabla}{\sqrt{1-\nabla}}$, where ∇ is the backward difference operator.

(b) Estimate the order of the polynomial which might be suitable for the following function:

x:	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7
$f(x)$:	0.577	0.568	0.556	0.540	0.520	0.497	0.471	0.442

Find the values of $f(2.5)$ and $f(2.65)$ using suitable difference formulae.