MCA (Revised)

Term-End Examination

08086

December, 2012

MCSE-004 : NUMERICAL AND STATISTICAL COMPUTING

Time : 3 hours *Maximum Marks : 100*

Note : *Question number* ***1*** *is* ***compulsory.*** *Attempt* ***any three*** *questions from the rest. Use of calculator is* ***allowed.***

1. (a) If $\pi = \frac{22}{7}$ is approximated as 3.14, find the absolute error, relative error and relative percentage error. **3**

(b) Determine the real root of the equation $x^3 - x^2 - 2 = 0$, correct to one decimal place, using Regula-Falsi method. **6**

(c) Solve the following system of equations by Jacobi iteration method. **6**

$$8x - 3y + 2z = 20$$

$$4x + 11y - z = 33$$

(Perform three iterations) $6x + 3y + 12z = 35$

(d) Prove that $\Delta \{ \log f(x) \} = \log \left[\frac{1+\Delta f(x)}{f(x)} \right]$. 3

(e) Determine the polynomial in x, by using Lagrange's interpolation, from the following data. 6

x	0	1	3	5	6	9
$y = f(x)$	-18	0	0	-248	0	13104

(f) Find the value of $\int_1^5 \log_{10} x \, dx$, taking B subintervals correct to four decimal places by Trapezoidal rule. 6

(g) The length of metallic strips produced by a machine has mean 100 cm and variance 2.25 cm. Only strips with weight between 98 and 103 cm are acceptable. What proportion of strips will be acceptable ? You may assume that the length of a strip has a Normal Distribution. 6

(h) What do you mean by term "Random Variable", classify them ? How you analyse which probability distribution is applicable on which type of random variable ? 4

2. (a) Verify that propagated error in addition is given by 3

$$e_{x+y} = r_x \frac{x}{x+y} + r_y \frac{y}{x+y}$$

where r_x and r_y are relative error.

(b) The quadric equation $x^4 - 4x^2 + 4 = 0$ has a double root. Starting with $x_0 = 1.5$ compute two iterations by Newton Raphson method. 6

(c) Solve the linear system of equations 8

$$10\ X_1 - X_2 + 2X_3 = 6$$
$$-X_1 + 11X_2 - X_3 + 3X_4 = 25$$
$$2X_1 - X_2 + 10X_3 - X_4 = -11$$
$$3X_2 - X_3 + 8X_4 = 15$$

by Gauss Seidel method rounded to four decimal places.

(d) Let $a = 0.41$, $b = 0.36$ and $c = 0.70$ prove 3

$$\frac{(a-b)}{c} \neq \frac{a}{c} - \frac{b}{c}$$

3. (a) Find Newton's Backward Difference form of interpolating polynomial for the data : 6

x :	4	6	8	10
$f(x)$:	19	40	79	142

Hence interpolate $f(9)$.

(b) Calculate the value of integral $\int_4^{5.2} \log x \, dx$ 6

by using

(i) Trapezoidal Rule (ii) Weddle's Rule

(c) Solve the Intermediate Value Problem 8

(IVP) $Y' = 2Y + 3e^t$; $Y(0) = 0$ by using Classical Runge - Kutta method of O (h^4). Find Y (0.1), Y (0.2), Y (0.3) using $h = 0.1$.

4. (a) 1000 light bulbs with a mean life of 120 days are installed in a new factory and their length of life is normally distributed with standard deviation of 20 days. 8

(i) How many bulbs will expire in less than 90 days ?

(ii) If it is decided to replace all the bulbs together, what interval should be allowed between replacements if not more than 10% should expire before replacement ?

(b) In partially destroyed laboratory record of an analysis of correlation data, the following results are legible 12

Variance of $X = 9$

Regression Equations : $8X - 10Y + 66 = 0$

$40X - 18Y - 214 = 0$

What are :

(i) the mean values of X and Y

(ii) the correlation coefficient between X and Y

(iii) standard deviation of Y.

5. (a) What do you mean by the term "Accuracy" and "Precision", how they are related to significant digits ? 4

(b) Evaluate $\int_0^1 \frac{dx}{1+x}$ using 8

(i) Composite Trapezoidal rule

(ii) Composite Simpson rule with 2 and 4 subintervals.

(c) Fit a straight line to the following data regarding x as the independent variable : 8

x :	0	1	2	3	4
y :	1.0	1.8	3.3	4.5	6.3

Hence find the difference between the actual value of y and the value of y obtained from the fitted curve when $x=3$.