MCA/IS/106/13

MCA 1st Semester Examination, 2013

MCA

PAPER – CS/MCA/106

Full Marks : 100

Time : 3 hours

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

GROUP – A

(*Computer Based Numerical and Statistical Method*)

Answer **Q. No.1** and any **two** from the rest

1. Describe Gauss-Seidel method for numerical solution of a system of linear equations, stating the condition of convergence. 5

2. (*a*) What is interpolation ? Establish Lagrange interpolation formula. What are its advantages and disadvantages ?

(*b*) From the following table, find the value of $\log_{10}2{\cdot}15$ using Newton's forward interpolation formula.

x	2·0	2·2	2·4	2·6	2·8	3·0
$\log_{10}x$	0·30103	0·34242	0·38021	0·41497	0·44716	0·47721

(1 + 5 + 2) + 7

3. (*a*) Obtain trapezoidal rule for numerical integration and interpret it geometrically.

(*b*) Evaluate the integral

$$\int_0^{10} \frac{dx}{(1+x^2)^{3/2}}$$ by Simpson's 1/3 rule.

(*c*) Solve the following system of equation using Gauss elimination method :

$$2x + y + 4z = 12$$
$$8x - 3y + 2z = 20$$
$$4x + 11y - z = 33.$$

5 + 5 + 5

4. (*a*) Describe Newton-Raphson method for computing a simple real root of an equation $f(x) = 0$

(*b*) Find a real root of the equation

$$\sin x = 10\,(x - 1)$$

using Bisection method.

(*c*) Use Runge-Kutta method of order 4, to find $y\,(0{\cdot}2)$ given that

$$\frac{dy}{dx} = 3x + \frac{1}{2}y,\ y(0) = 1,\ h = 0{\cdot}1$$

5 + 5 + 5

GROUP – B

(Numerical Analysis)

Answer **Q. No.1** or **2** and any **two** from the rest

1. (*a*) Define Point estimation and Interval estimation procedure. 2 + 2

(*b*) What do you mean by unbiased estimator and minimum variance unbiased estimator of a parameter? 2 + 2

(*c*) $X \sim N(\mu, \sigma^2)$. Find an unbiased estimator of μ. 2

(*d*) If the variances of independent and unbiased estimators T_1, T_2, T_3 of θ are the ratio 2 : 3 : 5, which of the following estimators of θ would you prefer most ? 5

$$\frac{2T_1 + T_2 + T_3}{4}, \frac{T_1 + T_2 + 2T_3}{4}, \frac{T_1 + 2T_2 + T_3}{4}.$$

Or

2. (*a*) What is random sampling procedure ? 3

(*b*) Distinguish between sampling error and non-sampling error. 3

(*c*) Explain the procedure of simple random sampling, stratified random sampling and systematic random sampling scheme for estimating unknown parameters of a population. 3 + 3 + 3

3. (*a*) Define correlation coefficient. 3

(*b*) Show that the numerical value of correlation coefficient is independent of change of origin and scales of the variables. 3

(*c*) What is multiple correlation coefficient ? Also established it. 4

4. Write short notes from the topic (any *four*) : $2\frac{1}{2} \times 4$

(*i*) Population

(*ii*) Sample

(*iii*) Standard deviation

(*iv*) Standard error

(*v*) Parameter

(*vi*) Statistic

(*vii*) Degrees of freedom.

5. (*a*) Given that the population density function

$$f(x, \theta) = \theta\, e^{-\theta x},\ 0 \leq x < \infty,\ \theta > 0.$$

The null hypothesis $H_0 : \theta = 2$ against the one sided alternative hypothesis $H_1 : \theta > 2$ will be tested on the following procedure. H_0 should be rejected if a sample x drawn from the population is greater than or equal to 6. Find the probability of Type I error and the power of the test. 5

(*b*) For a frequency distribution the upper class boundary bears a constant ratio e^r to the lower class boundary. If x_i and f_i be respectively the class mark and the frequency of the i th class and G be the geometric mean of the distribution, show that

$$\log G = \log x_i + \frac{\log r}{n} \sum_{i=1}^{k} (i-1) fi. \qquad 5$$