2012

MCA

1st Semester Examination

NUMERICAL ANALYSIS

PAPER—MCA-106

Full Marks : 100

Time : 3 Hours

The figures in the margin indicate full marks.

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

Illustrate the answers wherever necessary.

Group—A

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

1. Describe Gaussian elimination method for numerical solution of a system of linear equations. 5

2. (a) Use Gauss elimination method to find the inverse of the following matrix : 8

$$\begin{pmatrix} 1 & 1 & 1 \\ 2 & 3 & 1 \\ 1 & -1 & -1 \end{pmatrix}$$

(b) A table of a polynomial function p(x) is given below :

i	:	0	1	2	3	4
x_i	:	– 1·5	– 0·75	0	0·75	1.5
p(xi)	:	–14·1014	– 0·9316	0	0·9316	14·1014

(i) Find an interpolation formula for given this set of known values of p(x).

(ii) Calculate the values of p(x) at x = –0.85 and x = 1·25.

(iii) What assumption is made by you at the time of computing p(2.0) ? 4+2+1

3. (a) Obtain Simpson's $\frac{1}{3}$rd rule for numerical integration and give the geometrical significance of it.

(b) Evaluate the integral

$$\int_0^{\pi/2} \sqrt{1 - 0{\cdot}162\sin^2\theta}\, d\theta$$

by Simpson's $\frac{3}{8}$th rule.

(c) Show that the Newton-Raphson process has quadratic convergence. 5+5+5

4. (a) Explain the method of bisection for computing a real root of an equation f(x) = 0.

(b) Use Newton-Raphson method to evaluate a real root of the following equation :

$$10^x + x - 4 = 0$$

(c) Use Euler's modified method, compute y(4·4) where

$$\frac{dy}{dx} = \frac{2 - y^2}{5x},\ y(4) = 1.$$ 4+5+6

Group—B

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

1. (a) Obtain the variance of the first 'n' natural numbers. 5

Or

(b) Write a note on (i) data validation, and (ii) sampling errors. 2·5×2

2. (a) A variable takes the values a, ar, ar^2, ..., ar^{n-1} each with frequency unity. If A, G, H represent A.M., G.M., and H.M. respectively, then show that :

$$A = a\left(\frac{1-r^n}{1-r}\right),\ G = ar^{\frac{n-1}{2}},\ H = \frac{an(1-r)^{n-1}_r}{1-r^n}.$$ 6

(b) Answer the following questions for the distribution, given below :

(i) Find the number of students obtaining distinction i.e. 75% or more marks.

(ii) What should be the pass marks in order that the declared result is 70% :

Marks	No. of students
0 – 10	5
10 – 20	6
20 – 30	8
30 – 40	10
40 – 50	14
50 – 60	15

6

(c) Distinguish between absolute and relative measures of dispersion. 3

3. (a) Why there are two regression lines? 2

(b) If the regression lines are $x + 6y = 6$ and $3x + 2y = 10$, find the means and the correlation coefficient. 6

(c) Compute the quadratic curve for regression. Extend this approach to derive 'n' degree regression curve. 4+3

4. (a) Define continuous random variable and show that for normal distribution, median equals mode and mean. 5

(b) The probability density function of a random variable(X) is given by :

$f(x) = Kx^3 (1 - x^2)$; $0 < x < 1$

$= 0$; otherwise

Identify the distribution and find :

(i) The value of K ;

(ii) Mean and variance of X. 6

(c) Define Moment generating function. State any two properties of it. 2+2

[Internal Assessment — 30]

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