No. of Printed Pages : 5

**MCSE-004**

# MCA (Revised)

## Term-End Examination

07155

**June, 2018**

## MCSE-004 : NUMERICAL AND STATISTICAL COMPUTING

*Time : 3 hours* *Maximum Marks : 100*

***Note :*** *Question no. 1 is* ***compulsory****. Attempt any* ***three*** *questions from the rest. Use of calculator is allowed.*

**1.** (a) Define relative and percentage error. Find the relative and percentage error when the value of $\pi = \frac{22}{7}$ is approximated to 3·14. *4*

(b) Find the value of 'e', correct to 3 decimal places. *4*

$$e = 1 + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \ldots$$

(c) Use the Newton-Raphson method to find the root of the equation $x^3 - 2x - 5 = 0$. Perform two iterations. Use initial approximation $x_0 = 2$. *4*

(d) Solve the following system of linear equations using the Gauss Elimination method : 6

$$x_1 + x_2 + x_3 = 3$$

$$4x_1 + 3x_2 + 4x_3 = 8$$

$$9x_1 + 3x_2 + 4x_3 = 7$$

(e) Obtain the forward difference interpolating polynomial from the following set of nodes : 6

| x | f(x) |
|---|---|
| 0 | 0 |
| 1 | 7 |
| 2 | 26 |
| 3 | 63 |
| 4 | 124 |
| 5 | 215 |
| 6 | 342 |
| 7 | 511 |

(f) Evaluate the integral $\int_0^1 \frac{dx}{1+x}$ using Simpson's $\frac{3}{8}^{th}$ rule with $h = \frac{1}{3}$. 6

(g) A farmer buys a quantity of cabbage seeds from a company that claims that approximately 90% of the seeds will germinate if planted properly. If four seeds are planted, what is the probability that exactly two will germinate ? 6

(h) The tangent of the angle between the lines of regression of y on x and x on y is 0·6 and $\sigma_x = \frac{1}{2}\sigma_y$. Find $\sigma_{xy}$. 4

2. (a) Solve the following system of equations by using LU Decomposition method : 6

$$x + y = 2$$

$$2x + 3y = 5$$

(b) Find the Lagrange interpolating polynomial that fits the following data : 7

| x | 0 | 1 | 2 | 5 |
|---|---|---|---|---|
| f(x) | 2 | 3 | 12 | 147 |

(c) Calculate the value of the integral $\int_4^{5.2} \log x \, dx$ using Weddle's rule. 7

3. (a) Show that the moment generating function of a random variable X which is chi-square distributed with $v$ degrees of freedom is

$$M(t) = (1 - 2t)^{-v/2}.$$ 5

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

Variance of X = 9

Regression equations

$$8x - 10y + 66 = 0$$

$$40x - 18y - 214 = 0$$

Find

(i) the mean values of x and y,

(ii) the correlation coefficient between x and y, and

(iii) the standard deviation of y. *12*

(c) What is the utility of residual plots ? Also give one disadvantage of residual plots. *3*

4. (a) Apply the fourth order Runge-Kutta method to the following differential equation :

$$\frac{dy}{dx} = -2xy^2$$

$$y(0) = 1$$

Obtain y(0·2), taking h = 0·2. *6*

(b) Find the probability that an individual's IQ score is between 91 and 121. Provided : the individual IQ score has normal distribution with mean 100 and variance 225. *6*

(c) Write short notes on any ***two*** of the following : *4+4=8*

(i) Goodness of Fit

(ii) Newton-Cotes Formula

(iii) Non-linear Regression

**5.** (a) Solve by Jacobi's method, the following system of linear equations : *7*

$$2x_1 - x_2 + x_3 = -1$$

$$x_1 + 2x_2 - x_3 = 6$$

$$x_1 - x_2 + 2x_3 = -3$$

(b) Suppose that the amount of time one spends in a bank to withdraw cash from an evening counter is exponentially distributed with mean 10 minutes, that is, $\lambda = \frac{1}{10}$. What is the probability that the customer will spend more than 15 minutes at the counter ? *6*

(c) What do you mean by pseudo-random number generation ? What is the practical advantage of the concept of random number generation ? *7*