**MCSE-004**

# MCA (Revised)

## Term-End Examination

## June, 2016

07346

## 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) If $\pi = \frac{22}{7}$ is approximated as 3·14, find the absolute error, relative error and relative percentage error. *3*

(b) Solve the following system of equations by Jacobi iteration method :

$$8x - 3y + 2z = 20$$
$$4x + 11y - z = 33$$
$$6x + 3y + 12z = 35$$

(Perform three iterations) *6*

(c) Find the real root of the equation $x = e^{-x}$, using Newton-Raphson method. List the cases where Newton's method fails. *4+2*

(d) Determine the polynomial in x that best fits as approximation of y 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 |

(e) Find the value of $\int_1^5 \log_{10} x \, dx$, taking 8 sub-intervals, correct to four decimal places, by Trapezoidal rule. *6*

(f) In the table below the values of y are consecutive terms of a series of which the number 21·6 is the $6^{th}$ term. Find the first and the tenth term of the series. *8*

| x | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|
| y | 2·7 | 6·4 | 12·5 | 21·6 | 34·3 | 51·2 | 72·9 |

(g) Evaluate the integral $\int_1^4 x^2 dx$ using Weddle's rule with h = 0·5. *5*

2. (a) Find Newton's Backward Difference from the interpolating polynomial for the following data :

| x | 4 | 6 | 8 | 10 |
|---|---|---|---|---|
| f(x) | 19 | 40 | 79 | 142 |

Hence using the polynomial interpolate f(9). *6*

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

(i) Composite Trapezoidal rule,

(ii) Composite Simpson rule with 2 and 4 subintervals. *8*

(c) The table below gives the value of tan x for $0 \cdot 10 \leq x \leq 0 \cdot 30$ :

| x | 0·10 | 0·15 | 0·20 | 0·25 | 0·30 |
|---|---|---|---|---|---|
| y = tan x | 0·1003 | 0·1511 | 0·2027 | 0·2553 | 0·3093 |

Find (i) tan 0·12, and (ii) tan 0·26. *6*

3. (a) A problem in statistics is given to the three students A, B and C, whose chances of solving it are $\frac{1}{2}, \frac{3}{4}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved ? *6*

(b) 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*

(c) Calculate the correlation coefficient for the following heights (in inches) of fathers (x) and their sons (y) : *8*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| x : | 65 | 66 | 67 | 67 | 68 | 69 | 70 |
| y : | 67 | 68 | 65 | 68 | 72 | 72 | 69 |

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

(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 ? *8*

(b) In a partially destroyed laboratory, the 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 : 12

(i) The mean values of X and Y

(ii) The correlation coefficient between X and Y

(iii) Standard deviation of Y

**5.** (a) Given $\frac{dy}{dx} = y - x$, where $y(0) = 2$.

Find $y(0 \cdot 1)$ and $y(0 \cdot 2)$, correct to four decimal places, using Runge-Kutta Second Order method. 8

(b) Write the pitfalls in the Gauss elimination method. 2

(c) Solve the initial value problem to compute approximation for $y(0 \cdot 1)$ and $y(0 \cdot 2)$, using Euler's method with $h = 0 \cdot 1$, $\frac{dy}{dt} + 2y = 3e^{-4t}$, $y(0) = 1$. Compare with exact solution $y(t) = \frac{5e^{-2t} - 3e^{-4t}}{2}$. 10