

BCA 2nd Semester Exam., 2016

MATHEMATICS

Time : 3 hours

Full Marks : 60

Instructions :

- (i) All questions carry equal marks.
 (ii) There are **SEVEN** questions in this paper.
 (iii) Attempt **FIVE** questions in all.
 (iv) Question Nos. **1** and **2** are compulsory.

1. Choose the correct answer (any six) :

(a) If the function $f(x) = x \sin x$ satisfies

$$f''(x) + f(x) + t \cos x = 0$$

then the value of t is

- (i) 1
 (ii) 2
 (iii) -2
 (iv) None of the above

(b) A non-zero polynomial $f(x)$ of degree 3 has roots at $x = 1$, $x = 2$ and $x = 3$. Which of the following is true?

- (i) $f(0) f(4) < 0$
 (ii) $f(0) f(4) > 0$
 (iii) $f(0) + f(4) > 0$
 (iv) $f(0) + f(4) < 0$

(c) The real root of the equation $\cos x - 3x + 1 = 0$ correct up to 4 decimal places by the method of iteration is

- (i) 0.8071
 (ii) 0.6071
 (iii) 0.7071
 (iv) 0.9071

(d) The process of estimating the value of dependent variable at an intermediate value is called

- (i) interpolation
 (ii) extrapolation
 (iii) estimation
 (iv) dependency

(e) Simpson's $\frac{1}{3}$ rd rule is obtained by taking $n = \text{---}$ in the general quadrature formula.

- (i) 1 (ii) 2
 (iii) 3 (iv) 4

- (f) Gauss-Jacobi method is a/an _____ method.
- non-iteration
 - iteration
 - algebraic
 - None of the above
- (g) Convergence in the Gauss-Seidel method is _____ as fast as Gauss-Jacobi method.
- thrice
 - same
 - twice
 - None of the above
- (h) Error in Simpson's $\frac{3}{8}$ th rule is _____ compared to Simpson's $\frac{1}{3}$ rd rule.
- small
 - negligible
 - zero
 - large
- (i) The _____ of a differential equation is the order of the highest derivative appearing in it.
- value
 - degree
 - dimension
 - order

- (j) Lagrange's polynomial of degree two passes
- one point
 - two points
 - three points
 - infinite points

2. Answer any three of the following :

- Explain with examples exact and approximate numbers.
- Describe the method of false position.
- If the matrix A is such that

$$A = \begin{pmatrix} 2 \\ -4 \\ 7 \end{pmatrix} (1 \ 9 \ 5)$$

then find $\det(A)$.

- Find x_3 for $f(x) = 0.75x^3 - 2x^2 - 2x + 4$ using Newton-Raphson method. Assume that $x_0 = 2$.
- In the LU decomposition of the matrix

$$\begin{pmatrix} 2 & 2 \\ 4 & 9 \end{pmatrix}$$

if the diagonal elements of U are both 1, then find the lower diagonal entry l_{22} of L .

- 3/ The velocity V km/min of a motorbike that starts from rest is given below :

t	2	4	6	8	10	12	14	16	18	20
V	10	18	25	29	32	20	11	5	2	0

Find the approximate distance covered in 20 minutes using Simpson's $\frac{1}{3}$ rd rule.

4. Describe Lagrange's interpolation formula. Consider the following x_i 's :

i	0	1	2
x_i	1	3	-2

Find $L_0(x)$, $L_1(x)$ and $L_2(x)$.

5. $f(x)$ is known and its values are given below. Here $f(x) = x^3 + 2x^2 + 3x + 1$:

x_i	0	1	2	3	4
f_i	1	7	23	55	109

Find $f(0.5)$ and $f(1.5)$ using Newton's forward difference formula.

6. Use Jacobi method to find the solution of the following set of linear equations :

$$5x_1 - 2x_2 + 3x_3 = -1$$

$$-3x_1 + 9x_2 + x_3 = 2$$

$$2x_1 - x_2 - 7x_3 = 3$$

7. Solve by Runge-Kutta method for the DE

$$\frac{du}{dx} = -2u + x + 4, \quad u(0) = 1$$

to obtain $u(0.2)$, using $\Delta x = 0.2$.
