2016

(5th Semester)

MATHEMATICS

FIFTH PAPER (MATH–351)

(Computer-oriented Numerical Analysis)

Full Marks : 75

Time : 3 hours

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

Answer **one** question from each Unit

UNIT—I

1. *(a)* Find a real root of the equation $x^3 \quad 3x \quad 1 \quad 0$ lying between 1 and 2 to two places of decimal by bisection method. 5

(b) Find the second difference of the polynomial

$$f(x) \quad x^4 \quad 12x^3 \quad 42x^2 \quad 30x \quad 9$$

taking $h \quad 2$. Express the result in normal polynomial form. 4+1=5

2. *(a)* Obtain the regula falsi formula to find the root of an algebraic or transcendental equation with an illustrative diagram/curve. 4+1=5

(b) Let $f(x)$ be a polynomial of degree n. Then prove that the nth difference of $f(x)$ is a constant and all higher order differences are zero, i.e.

$$^{r}[f(x)] \quad \begin{matrix} \text{constant} & \text{if } r \quad n \\ 0 & \text{if } r \quad n \end{matrix}$$

5

UNIT—II

3. *(a)* Obtain Newton's forward interpolation formula for interpolation with equal intervals of the argument. 6

(b) Find the form of the function $f(x)$ using Lagrange's interpolation formula from the following table : 4

x	3	2	1	–1
$f(x)$	3	12	15	–21

4. *(a)* Obtain Newton's divided difference interpolation formula for non-equal intervals of the argument. 6

(b) The population of a country in the decimal census were as under :

Year	1941	1951	1961	1971	1981
Population	46	67	83	95	102

Estimate the population for the year 1975. 4

UNIT—III

5. *(a)* Solve the following system of equations by Gaussian elimination method : 5

$$2x \quad y \quad 4z \quad 12$$
$$8x \quad 3y \quad 2z \quad 20$$
$$4x \quad 11y \quad z \quad 33$$

(b) By Crout's method, solve the following system of simultaneous equations : 5

$$x \quad y \quad z \quad 1$$
$$3x \quad y \quad 3z \quad 5$$
$$x \quad 2y \quad 5z \quad 10$$

6. *(a)* Solve the following by Gauss-Jordan method : 4

$$x \quad y \quad z \quad 9$$
$$2x \quad 3y \quad 4z \quad 13$$
$$3x \quad 4y \quad 5z \quad 40$$

(b) Explain Gauss-Seidel method with the proper algorithm. 6

UNIT—IV

7. *(a)* Obtain the formula for Simpson's one-third rule for numerical integration. 5

(b) Find the second derivative of $f(x)$ at $x \quad 3 \quad 0$ from the following table : 5

x	3·0	3·2	3·4	3·6	3·8	4·0
y	–14·000	–10·032	–5·296	–0·256	6·672	14·000

8. *(a)* Evaluate

$$I \quad {}_{0}^{/3} \frac{x}{\cos x}\, dx$$

by using trapezoidal rule up to four decimal places. 5

(b) Find the first derivative of $f(x)$ at $x \quad 0 \quad 4$ from the following table : 5

x	0·1	0·2	0·3	0·4
y	1·10517	1·22140	1·34986	1·49182

UNIT—V

9. *(a)* Compute $y(0\ \ 1)$ by Runge-Kutta method of fourth-order for the differential equation $\frac{dy}{dx}\ \ xy\ \ y^2$ with $y(0)\ \ 1$. 5

(b) Apply Euler's method with $h\ \ 0\ 025$ to find the solution of the equation $\frac{dy}{dx}\ \ \frac{y\ \ x}{y\ \ x}$ with initial condition $y(0)\ \ 1$ in the range $0\ \ x\ \ 0\ 1$. 5

10. *(a)* Solve $y\ \ \ y$ with $y(0)\ \ 1$ by using Milne's method $x\ \ 0\ 1$ to $x\ \ 2\ 7$ with $h\ \ 0\ 3$. 10

Or

(b) Given

$$\frac{dy}{dx}\ \ \frac{y}{x}\ \ \frac{1}{x^2},\ y(1)\ \ 1$$

evaluate $y(1\ 3)$ by modified Euler's method.

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Subject Code : V/MAT (v)

Booklet No. A

Date Stamp ....

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To be filled in by the Candidate

DEGREE 5th Semester
(Arts / Science / Commerce /
.......................) Exam., **2016**

Subject ....
Paper ....

INSTRUCTIONS TO CANDIDATES

1. **The Booklet No. of this script should be quoted in the answer script meant for descriptive type questions and vice versa.**
2. **This paper should be ANSWERED FIRST and submitted within 1 (one) Hour of the commencement of the Examination.**
3. **While answering the questions of this booklet, any cutting, erasing, over-writing or furnishing more than one answer is prohibited. Any rough work, if required, should be done only on the main Answer Book. Instructions given in each question should be followed for answering that question only.**

To be filled in by the Candidate

DEGREE 5th Semester
(Arts / Science / Commerce /
.......................) Exam., **2016**

Roll No. ....
Regn. No. ....

Subject ....
Paper ....

Descriptive Type
Booklet No. B ....

Signature of Scrutiniser(s)

Signature of Examiner(s)

Signature of Invigilator(s)

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2016

(5th Semester)

MATHEMATICS

FIFTH PAPER (MATH–351)

(Computer-oriented Numerical Analysis)

(PART : A—OBJECTIVE)

(*Marks* : 25)

Answer **all** questions

SECTION—A

(*Marks* : 10)

Each question carries 1 mark

Put a Tick ☑ mark against the correct answer in the box provided :

1. By definition of forward difference operator, $^2 f(x)$ equals to

(a) $f(x \quad h) \quad f(x)$ ☐

(b) $f(x \quad 2h) \quad f(x \quad h) \quad f(x)$ ☐

(c) $f(x \quad 2h) \quad 2f(x \quad h) \quad f(x)$ ☐

(d) $f(x \quad 2h) \quad 2f(x \quad h) \quad f(x)$ ☐

2. A factorial function, denoted by $x^{(n)}$, where n is a positive integer, is a product of the form given by

(a) $(x \quad h)(x \quad 2h)\cdots(x \quad nh)$ ☐

(b) $x(x \quad h)(x \quad 2h)\cdots[x \quad (n \quad 1)h]$ ☐

(c) $(x \quad h)(x \quad 2h)\cdots[x \quad (n \quad 1)h]$ ☐

(d) $x(x \quad h)(x \quad 2h)\cdots(x \quad nh)$ ☐

3. Second divided difference with arguments 2, 4, 9 of the function $f(x) \quad x^2$ is

(a) 2 ☐

(b) 1 ☐

(c) 0 ☐

(d) −1 ☐

4. Let observations for the function $y \quad f(x)$ at the points $x \quad a, a \quad h, a \quad 2h, \cdots, a \quad nh$ be $f(a)$, $f(a \quad h)$, $f(a \quad 2h), \cdots, f(a \quad nh)$. Then the method of finding $f(m)$ at $x \quad m$, where m lies in the range of a and $a \quad nh$ is known as

(a) intrapolation ☐

(b) extrapolation ☐

(c) interpolated value ☐

(d) interpolation ☐

5. Back-substitution procedure of solving a simultaneous linear equation is given by

(a) Gauss elimination method ☐

(b) Crout's method ☐

(c) Gauss-Seidel method ☐

(d) None of the above ☐

6. Indirect method of solving a simultaneous linear equation be represented by

(a) Gauss elimination method ☐

(b) Gauss-Jordan method ☐

(c) Gauss-Seidel method ☐

(d) None of the above ☐

7. Simpson's rule is based on approximating the function $f(x)$ by fitting quadratics through sets of

(a) two points ☐

(b) three points ☐

(c) four points ☐

(d) two or four points ☐

8. The value of f (4) from the table

x	1	2	3	4
y	6	12	20	30

is

(a) 1 ☐

(b) 10 ☐

(c) 11 ☐

(d) 21 ☐

9. Which of the following statements is correct?

(a) Runge-Kutta method is not self-starting ☐

(b) Predictor-corrector method is not self-starting ☐

(c) Both Runge-Kutta method and predictor-corrector method are self-starting ☐

(d) Neither Runge-Kutta method nor predictor-corrector method is self-starting ☐

10. The ordinary differential equation

$$\frac{dy}{dx}^{2} \quad y \quad x$$

is of

(a) first order and first degree ☐

(b) second order and first degree ☐

(c) second order and second degree ☐

(d) first order and second degree ☐

SECTION—B

(*Marks* : 15)

Each question carries 3 marks

1. If $x^{(r)}$ is the factorial notation of x raised to power r factorial, then show that $x^{(r)}$ $rhx^{(r \quad 1)}$, where the interval of differencing is h.

2. If $f(x) \quad \frac{1}{x^2}$, then find the divided difference of $[a, b, c]$.

3. Solve the given equations by Gauss-Jordan method :

$$x \quad 2y \quad 4$$
$$x \quad y \quad 13$$

4. Evaluate

$$_{0}^{1} \frac{dx}{1 \quad x^2}$$

using trapezoidal rule with $h \quad 0 \;\, 2$. Hence, determine the value of .

5. Using Taylor's method, find $y(0\ \ 1)$ correct to three decimal places from the equation

$$\frac{dy}{dx} \quad 2xy \quad 1 \text{ with } y_0 \quad 0$$

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