This question paper contains 7 printed pages]

1655

M.A./M.Sc. (Previous)

Examination, 2017

MATHEMATICS

Paper V

(Discrete Mathematics and Numerical Analysis)

Time Allowed : Three Hours

Maximum Marks : 100

This question paper contains **three** *sections as under :*

Section-A ***Max. Marks-10***

This section contains **one** *compulsory question with* **10** *parts, having* **2** *parts from each units, short answer in* **20** *words for each part.* **All** *questions carry equal marks.*

Section-B ***Max. Marks-50***

This section contains **10** *questions having* **2** *questions from each unit. Answer* **5** *questions (***250** *words each) selecting* **one** *question from each unit.* **All** *questions (questions may have sub-division) covering all units but not more than* **one** *question from each unit. Answer any* **two** *questions (***500** *words each).* **All** *questions carry equal marks.*

Note : Non-programmable scientifc calculator is allowed.

SECTION-A

1. (*i*) Define pigeonhole principle.

(*ii*) Define Hamiltonian graph.

(*iii*) Define binary tree.

(*iv*) Define partially ordered set.

(*v*) Write generalized Newton-Raphson formula for determining multiple root.

(*vi*) Write iterative formula for Chebyshev method.

(*vii*) Write Cholesky's factorization of a matrix.

(*viii*) Define dominant eigen value of a matrix.

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(ix) Write Milne's predictor-corrector formula.

(x) Write fourth order Range-Kutta method.

SECTION-B

UNIT-I

2. Prove that "If n is an integer not divisible by 3, then $n^2 \equiv 1 \pmod 3$".

3. Prove that a simple graph with n vertices and k components can have at most :

$$\frac{1}{2}(n-k)(n-k+1) \text{ edges.}$$

UNIT-II

4. Prove that the number of internal vertices in a binary tree is always less than the number of pendant vertices.

5. In any Boolean algebra, prove that the order relation

$$\leq (a \leq b \Leftrightarrow a\, b' = 0)$$

6. Find two nearly equal roots of the equation :

$$x^4 - 5x^3 - 12x^2 + 76x - 79 = 0$$

close to $x = 2$ using Newton-Raphson method.

7. Fit the curve $p.V^r = k$ to the following data :

p	V
0.5	1.62
1	1
1.5	0.75
2	0.62
2.5	0.52
3	0.46

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partial pivoting, the following system of equations :

$$x + y + z = 7$$

$$3x + 3y + 4z = 24$$

$$2x + y + 3z = 16$$

9. Solve the system of equations using Relaxation method :

$$2x_1 - 13x_2 - 3x_3 = 49$$

$$5x_1 - 6x_2 + 17x_3 = 25$$

$$11x_1 + 2x_2 - 4x_3 = -31$$

UNIT-V

10. Given that :

$$\frac{dy}{dt} = \frac{ty}{2}$$

where $y(0) = 1$, $y(0.1) = 1.01$, $y(0.2) = 1.022$ and $y(0.3) = 1.023$.

Compute $y(0.4)$ using Adams-Moulton predictor-corrector formula.

11. Find the solution of the boundary value problem

$$y'' = y + x;\ y(0) = 0,\ y(1) = 0$$

with step size $h = 0.25$.

SECTION-C

12. (*a*) Using mathematical induction, prove that :

$$2^n > n^2, \text{ if } n \geq 5.$$

(*b*) How many positive integers not exceeding 500 are divisible by 7 or 11 ?

13. (*a*) Express the following function in disjunctive normal form :

$$F(x, y, z) = (x + y) \cdot (z' y')'$$

(*b*) Find the inverse of the following matrix by factorization method :

$$\begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \end{bmatrix}.$$

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$$x^3 - 2x - 5 = 0$$

by Birge-Vieta method correct upto four places of decimal. Obtain also deflated polynomial

15. (*a*) Using Rutishauser method, compute all the eigen values of the matrix :

$$A = \begin{bmatrix} 3 & 1 \\ 1 & 1 \end{bmatrix}.$$

(*b*) Using fourth order Runge-Kutta method with one step, compute $y(0.1)$ to five places of decimal, if :

$y' = 0.31 + 0.25y + 0.3t^2$ and

$y(0) = 0.72.$

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