This question paper contains 8 printed pages]

1655

M.A./M.Sc. (Previous) Examination, 2019

MATHEMATICS

Paper-V

DISCRETE MATHEMATICS AND NUMERICAL ANALYSIS

Time Allowed : Three Hours

Maximum Marks : 100

Note : *Non-programmable Scientific Calculator is allowed in this paper.*

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

Section-A **खण्ड 'अ'** ***Max. Marks-10***

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

इस खण्ड में ***एक*** *अनिवार्य प्रश्न है जिसमें प्रत्येक इकाई से* ***2*** *लघु प्रश्न लेते हुये कुल* ***10*** *लघु प्रश्न होंगे। प्रत्येक लघु प्रश्न का उत्तर* ***20*** *शब्दों से अधिक में न हो।* ***सभी*** *प्रश्नों के अंक समान हैं।*

Section-B **खण्ड 'ब'** ***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 carry equal marks.*

इस खण्ड में प्रत्येक इकाई से ***2*** *प्रश्न लेते हुये कुल* ***10*** *प्रश्न हैं। प्रत्येक इकाई से एक प्रश्न का चयन करते हुये कुल* ***5*** *प्रश्नों के उत्तर देने हैं। प्रत्येक प्रश्न का उत्तर* ***250*** *शब्दों से अधिक में न हो।* ***सभी*** *प्रश्नों के अंक समान हैं।*

Section-C **खण्ड 'स'** ***Max. Marks-40***

This section contains ***4*** *descriptive type questions (questions may have sub-divisions) covering all units but not more than* ***one*** *question from each unit. Answer any* ***two*** *questions (****500*** *words each).* ***All*** *questions carry equal marks.*

इस खण्ड में ***4*** *प्रश्न वर्णनात्मक होंगे। प्रश्न में भाग भी हो सकते हैं जो सभी इकाइयों में से दिये जायेंगे, किन्तु एक इकाई से एक से अधिक प्रश्न नहीं होगा। किन्हीं* ***दो*** *प्रश्नों के उत्तर दिये जाने हैं। प्रत्येक प्रश्न का उत्तर* ***500*** *शब्दों से अधिक न हो।* ***सभी*** *प्रश्नों के अंक समान हैं।*

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Section A

1. (*a*) Prove that $p \vee (p \wedge q) \equiv p$.

(*b*) Define planer graph.

(*c*) Define binary tree.

(*d*) In Boolean algebra (B, +, •, 0, 1) prove that for $a \in B \Rightarrow a + a = a$.

(*e*) Write order of convergence of Regula-Falsi Method.

(*f*) Write normal equation for fitting straight line $y = a + bx$ for data (x_i, y_i) $(i = 1, 2, \ldots\ldots n)$

(*g*) Write the difference between Crout's method and Dolittle method for solving simultaneous system of equations.

(*h*) Write conditions required to solve a simultaneous system of equations by Cholesky method.

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(*i*) Write predicator formula of Milne's method.

(*j*) Explain finite difference scheme in brief.

Section B

UNIT-I

2. Show that for any positive integer $n > 1$

$$\frac{1}{\sqrt{1}} + \frac{1}{\sqrt{2}} + \ldots + \frac{1}{\sqrt{n}} > \sqrt{n}.$$

3. If G is a connected planer simple graph with 'e' edges and 'v' vertices and if 'r' be the number of regions in a planer graph representation of G, then prove that $r = e + 2 - v$.

UNIT-II

4. Define complete binary tree. If h is the height of a binary tree with n vertices, then prove that :

$$(h + 1) \leq n \leq (2^{h+1} - 1) \qquad 2+8$$

5. Write conjunctive normal form of $f(x_1, x_2, x_3) = [x_1 + (x_1' + x_2')'].[x_1 + (x_2' - x_3')']$.

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UNIT-III

6. Explain convergence of Newton-Raphson method.

7. Use method of least square to fit the curve $y = \frac{A}{x} + B\sqrt{x}$ from the following data :

	x_0	x_1	x_2	x_3	x_4	x_5
x	0.1	0.2	0.4	0.5	1	2
y	21	11	7	6	5	6

UNIT-IV

8. Find the inverse of matrix A using Gauss elimination method where

$$A = \begin{bmatrix} 4 & 1 & 2 \\ 2 & 3 & -1 \\ 1 & -2 & 2 \end{bmatrix}$$

9. Using power method find dominant eigen value and corresponding Eigen vector of matrix :

$$A = \begin{bmatrix} 3 & 0 & 1 \\ 2 & 2 & 2 \\ 4 & 2 & 5 \end{bmatrix}$$

UNIT-V

10. Using improved Euler's method find $y(0.1)$ with step size $h = 0.02$, given $\frac{dy}{dx} = \frac{y-x}{y+x}$ with $y(0) = 1$.

11. Using Milne's method, find $y(0.8)$ given $\frac{dy}{dx} = \frac{1}{x+y}$ and

x	0	0.2	0.4	0.6
y	2	2.0933	2.1755	2.2493

Section C

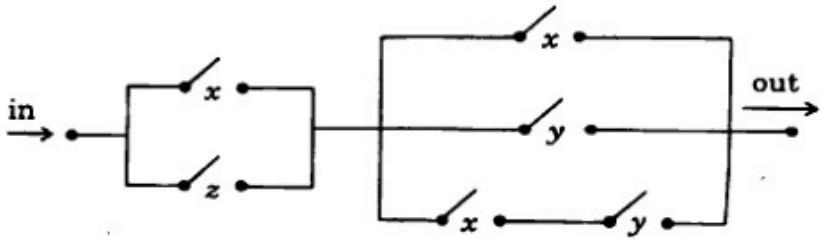
12. (a) Prove that every sequence of $(n^2 + 1)$ distinct real numbers contains a subsequence of $(n + 1)$ real numbers that either strictly increasing or strictly decreasing using pigeonhole principle.

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(b) Prove that necessary and sufficient condition for a connected graph G to be an Euler graph is that all vertices of graph G are of even degree.

13. (a) Prove that dual of a lattice is a lattice.

(b) Find simple form of switching circuit :



14. (a) Perform two iterations of Bairstaw method find two roots of given equation using (2, 2) as initial approximation

$$x^4 - 3x^3 + 20x^2 + 44x + 54 = 0.$$

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

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

15. (a) What do you mean by stability of a method. Explain stability analysis of Runge-Kutta method of fourth order. 5+5

(b) Solve by relaxation method :

$$9x - y + 2z = 9$$

$$x + 10y - 2z = 15$$

$$2x - 2y - 13z = -17$$

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