

CONTENTS

Sec. No.	subject	verse No.	Page No.
	FOREWORD		i
	PREFACE		v
	1. Introduction: 1.1 Magic square 1.2 Origin and early History 1.3 Loh Shu 1.4 Magic squares in Ṛg-veda 2. Nāgārjuna's pandiagonal magic squares: (i) Even Total (ii) Odd Total- Nāgārjunīya-square $N = 4, M = 100$, Fig. 8, 3. Varāhamihira Magic Squares (i). $N = 4, M = 34$, Fig. 16, (ii). $N = 4, M = 170$, Fig. 17, 4. Jaina Squares 5. <i>Bhadragaṇitam</i> 5.1 <i>Bhadragaṇitam and its scope</i> 5.2 Terminology : Kinds of cells, diagonals and Magic squares: 5.3 Nārāyaṇa's Results		xxii xxiii xxv xxvii xxix xxxv xxxvii xxxviii xli xliii
1	Preface : 1.1 Origin of the name <i>Bhadragaṇitam</i> : 1.2 Importance of <i>Bhadragaṇitam</i>	 1 2	1 1 1
2	Preliminary Remarks 2.1 Definitions in <i>Bhadragaṇita</i>	 3-7	2 2

	2.2: Square's constant or magic number (M) in a regular Magic square: Ex. 1.1 : $a = d = 1; n = 16; M = ?$ Ex. 1.2 : $a = d = 1; n = 36; M = ?$ Ex. 1.3 : $a = d = 1; n = 9; M = ?$ 2.3: First term and common difference of the series used in magic squares Ex. 2.1 : $n = 16; T = 400; a = ?, d = ?$ Ex. 2.2 : $n = 36; T = 1296; a = ?, d = ?$ Ex. 2.3 : $n = 9; T = 180; a = ?, d = ?$	8 9	5 7
3	Construction of (4x4) Magic square By right and left Knights move method	10-12	16
4	Varieties of (4×4) magic squares (Fig 36 (i); and Fig 36 (ii)) Ex. 4 : $n = 16; M = 34; a = d = 1$. Ex. 5.1 : $M = 40; N = 4; a = ?, d = ?$ Ex. 5.2 : $M = 64; N = 4; a = ?, d = ?$	13-14(i)	23
5	Use of irregular series in the formation of Magic squares 5.1 : Construction of magic square using irregular series: 5.1.1 Ex.1 (i) : $a = (1,6,11,16); d = 1; N = 4; M = 40$; Fig. 40 Ex 1 (ii): $a = (1,5,12,16); d = 1; N = 4; M = 40$; Fig. 41 Ex 1.(iii): $a = (2,6,11,15); d = 1; N = 4; M = 40$; Fig. 42. 5.1.2 Ex 2 (i) : $a = (7,12,17,22); d = 1; N = 4; M = 64$; Fig.43 Ex 2 (ii): $a = (4, 11,18,25); d = 1; N =$	14(ii)-15	40 41

	4; $M = 64$; Fig. 44 Ex. 2.(iii): ; $a = (1,10,19,28)$; $d = 1$; $N = 4$; $M = 64$; Fig.45 5.2: Determination Of Irregular Series: 5.2.1 : First Method Ex. 5.2.1.1 : $N = 4$; $M = 40$; $(-, -, -, -)$ Ex. 5.2.1.2 : $N = 4$; $M = 64$; $(-, -, -, -)$ 5.2.2 : Second Method : Ex. 5.2.2.1: $N = 4$; $M = 40$; Fig. 46, Fig. 47 Ex. 5.2.2.2: $N = 4$; $M = 64$; $(-, -, -, -)$	16-20(i) 20(ii)-23(i)	45
6	Alternative method of Change of Squares $N = 4$; $M = 34$; Fig. 48 Ex. 6 : $N = 4$; $M = 100$; Fig. 49.	23(ii)-24(i)	58
7	Construction of <i>samagarbha</i> squares by 7.1 : Superposition or Composition Method (<i>Karasamputa vidhāna</i>) Ex.7.1.1: $N = 4$; $M = 40$. Fig. 51 ; Fig. 52. Ex.7.1.2: $N = 4$; $M = 64$. Fig. 53 Ex.7.1.3: $N = 8$; $M = 260$. Fig. 54 Ex.7.1.4: $N = 8$; $M = 400$. Fig. 55 7.2 : Method of Modified version of knight's Move Examples : 7.2.1: $a = d = 1$; $N = 8$, $M = 260$, Fig.56 7.2.2: (i) $a = -13$; $d = 2$; $N = 8$;	24(ii)-29 30-31	61 61 72

	9.3.2 : $a = (1,7,13,26,32,38)$; $d = 1$ $N = 6$; $M = 132$; Fig. 76, Fig. 76 B ; Fig. 76 C .		
10	Alternative method of the use of Pīṭha-paṅkti Examples : 9.4.1 : $a =$ $d = 1$; $N = 6$; $M = 111$; Fig. 79, Fig. 80. 9.4.2: using the numbers of irregular series : $a=(2, 9, 16, 23, 30, 37)$; $d=1$ $N = 6$; $M = 132$; Fig. 83 10.4: $a = d = 1$; $N = 10$; $M = 505$; Fig. 87	37-40	111
11	<i>Viṣama- bhadra Saṃpuṭa vidhāna</i> (Method of Composition for Odd magic squares) Examples : 11.1 : $N = 3$; $M = 24$; Fig. 88 11.2 : $N = 5$; $M = 90$; Fig. 89 11.1 : $N = 7$; $M = 238$; Fig. 90	41-42	124
12	<i>Viṣama- bhadra Laghūpāya</i> Construction of Odd Magic Squares : Alternative Short Method : Examples : 12.1: $a = d = 1$; $N = 3$, $M = 15$, Fig. 91. ; Fig 92 (A to G) 12.2: $a = (3,7,11)$; $d = 1$. Fig 93 ; $N = 3$, $M = 24$, 12.3: $a = (4,10,16,22,28)$, $d = 1$. Fig 94 ; $N = 5$, $M = 90$, $d = 1$, 12.4 : $a = (7,15,23,31,39,47,55)$, $d = 1$, Fig 95 ; $N = 7$, $M = 238$,	43- 45(i)	129

13	Mixed Magic-squares and Magic-Figures: 13.1 : <i>Vitāna</i> ("Canopy") : Fig. 96. $M_{column} = 66$; $M_{row} = 132$; 13.2 : <i>Maṇḍapa</i> ("Altar") : Fig. 97. $M_4 = 66$; $M_8 = 132$. 13.3 : <i>Vajra</i> ("Diamond") : Fig.98. $M_4 = 66$; $M_8 = 132$. 13.4 : <i>Padma</i> ("Lotus") : Fig. 99. $M_4 = 66$; $M_8 = 132$.	46-49	142
14	<i>Vajra</i> ("Diamond"), <i>Pañkaja</i> ("Lotus") , <i>Sarvatobhadra</i> (Perfect magic square) 14.1 : <i>Vajra</i> ("Diamond") : (Fig.100) $M_4 = 130$, $M_8 = 260$, $M_{16} = 520$. 14.2 : <i>Maṇḍapa</i> ("Altar") : (Fig.101) $M_4 = 130$, $M_8 = 260$, $M_{16} = 520$. 14.3 : <i>Sarvatobhadra</i>: Fig.102, Fig.103, $M_4 = 130$, $M_8 = 260$, $M_{16} = 520$.	50	148
15	Magic Figures formed from Magic rectangle : 15.1 : <i>Dvādaśakara</i> ("Twelve Hands") : (Fig.104) $M_4 = 98$, $M_8 = 196$, $M_{12} = 294$, 15.2 : <i>Vajra Padma Padma</i> ("Diamond Lotus: (Fig.106) $M_4 = 98$, $M_8 = 196$, $M_{12} = 294$.	51	153
16	Ṣaṭkaja and Padmavṛtta ("Lotus circle") 16.1 : <i>Ṣaḍasra</i> (Hexagon) : $M_{12} = 294$. Fig.107	52-54(i)	157

	16.2 : Padma <i>vr̥tta</i> ("Inscribed Lotus") : $M_{12} = 294$. Fig.108		
17	Figures within figures: 17.1: Magic Triangle : $M = 400$. Fig.110 17.2 : Magic Cross : $M = 400$. Fig.111 17.3 : Magic Circles 17.3.1 : Magic circle from 3×3 square $M = 400$. Fig.113 17.3.2: : Magic circle from 4×4 square $M = 400$. Fig.115 17.3.3: Magic circle from 5×5 square $M = 400$. Fig.117 17.3.4 : Magic circle from 6×6 square $M = 400$. Fig.119 17.4.1: Magic circle from Magic rectangle $M = 400$. Fig.121 17.4.2: Magic circle from Magic rectangle $M = 360$. Fig.122.	54	161
18	Epilogue 18.1 : Limitations of the chapter 18.2: Author's Parentage, Identity and Time	55 1-5	171
19	Magic squares mentioned by Jain Scholars 19.1 : Dharmananda Squares (i). $N = 8$, $M = 260$, Fig. 123 (ii). $N = 12$, $M = 870$, Fig. 125		175

	(iii). $N = 4$, $M = 34$, Fig. 126(b) 19.2 : Sundarasūri Squares (i). $N = 3$, $M = 15$, Fig. 127 (ii). $N = 4$, $M = 32$, Fig. 129 (iii). $N = 5$, $M = 65$, Fig. 130 (iv). $N = 7$, $M = 175$, Fig. 131 (v). $N = 8$, $M = 260$, Fig. 132 (vi). $N = 9$, $M = 369$, Fig. 134		
20	Concluding Remarks		184
	Appendixes :		
	Appendix-1 : Definitions		188
	Appendix-2: कुट्टकः (<i>Kuṭṭaka</i>)		193
	Bibliography		202