



On Lateral Ternary Γ -Ideals of Ternary Γ -Semirings

M. Sajani Lavanya¹, Dr. D. Madhusudhana Rao² and V. Syam Julius Rajendra³

¹Lecturer, Department of Mathematics, A.C. College, Gunture, A.P. India.

²Head, Department of Mathematics, V. S. R & N.V.R. College, Tenali, A.P. India.

³Lecturer, Department of Mathematics, A.C. College, Guntur, A.P. India.

Abstract: In this paper we introduce the terms ternary Γ -semiring, commutative ternary Γ -semiring, left ternary Γ -ideal, lateral ternary Γ -ideal, right ternary Γ -ideal, ternary Γ -ideal, prime lateral ternary Γ -ideal, semiprime ternary Γ -ideal, irreducible ternary Γ -ideal and strongly irreducible ternary Γ -ideal and characterize the ternary Γ -ideals and proved many results.

Mathematics Subject Classification: 20G07, 20M10, 20M12, 20M14, 20N10.

Key Words: ternary Γ -semiring, lateral ternary Γ -ideal, ternary Γ -ideal, prime lateral ternary Γ -ideal, irreducible.

I. Introduction

The literature of ternary algebraic system was introduced by D. H. Lehmer [11] in 1932. He investigated certain ternary algebraic systems called triplexes which turn out to be ternary groups. The notion of ternary semigroups was known to S. Banach. He showed by an example that a ternary semigroup does not necessarily reduce to an ordinary semigroup. In [14], M. L. Santiago developed the theory of ternary semigroups and semiheaps. He devoted his attention mainly to the study of regular ternary semigroups, completely regular ternary semigroups, bi-ideals and intersection ideals in ternary semigroups, the standard embedding of a ternary semigroup and a semiheap with some of their applications. In [12], W. G. Lister characterized those additive subgroups of rings which are closed under the triple ring product and he called this algebraic system a ternary ring. He also studied the embedding of ternary rings, representation of ternary rings in terms of modules, semisimple ternary rings with minimum condition and radical theory of such rings. D. Madhusudhana Rao, A. Anjaneyulu and A. Gangadhara Rao [1] in 2012 made a study on Γ -ideals in Γ -semigroups. In 2011 [2] they studied about Γ -radicals in Γ -semigroups. VB Subramanyeswara Rao, A. Anjaneyulu, D. Madhusudhana Rao [15] studied about po- Γ -ideals in po- Γ -semigroups.

II. Lateral Ternary Γ -Ideal

Definition II.1: Let T and Γ be two additive commutative semigroups. T is said to be a **Ternary Γ -semiring** if there exist a mapping from $T \times \Gamma \times T \times \Gamma \times T$ to T which maps $(x_1, \alpha, x_2, \beta, x_3) \rightarrow [x_1 \alpha x_2 \beta x_3]$ satisfying the conditions :

$$i) [[a \alpha b \beta c] \gamma d \delta e] = [a \alpha [b \beta c \gamma d] \delta e] = [a \alpha b \beta [c \gamma d \delta e]]$$

$$ii) [(a + b) \alpha c \beta d] = [a \alpha c \beta d] + [b \alpha c \beta d]$$

$$iii) [a \alpha (b + c) \beta d] = [a \alpha b \beta d] + [a \alpha c \beta d]$$

$$iv) [a \alpha b \beta (c + d)] = [a \alpha b \beta c] + [a \alpha b \beta d] \text{ for all } a, b, c, d \in T \text{ and } \alpha, \beta, \gamma, \delta \in \Gamma.$$

Obviously, every ternary semiring T is a ternary Γ -semiring. Let T be a ternary semiring and Γ be a commutative ternary semigroup. Define a mapping $T \times \Gamma \times T \times \Gamma \times T \rightarrow T$ by $a \alpha b \beta c = abc$ for all $a, b, c \in T$ and $\alpha, \beta \in \Gamma$. Then T is a ternary Γ -semiring.

Definition II.2: An element 0 of a ternary Γ -semiring T is said to be an **absorbing zero** of T provided $0 + x = x = x + 0$ and $0 \alpha a \beta b = a \alpha 0 \beta b = a \alpha b \beta 0 = 0 \forall a, b, x \in T$ and $\alpha, \beta \in \Gamma$.

Definition II.3 : Let T be ternary Γ -semiring. A non empty subset ' S ' is said to be a **ternary sub Γ -semiring** of T if S is an additive subsemigroup of T and $a \alpha b \beta c \in S$ for all $a, b, c \in S$ and $\alpha, \beta \in \Gamma$.

Note II.4 : A non empty subset S of a ternary Γ -semiring T is a ternary sub Γ -semiring if and only if $S + S \subseteq S$ and $S \Gamma S \Gamma S \subseteq S$.

Definition II.5 : A nonempty subset A of a ternary Γ -semiring T is said to be **left ternary Γ -ideal** of T if (1) $a, b \in A$ implies $a + b \in A$. (2) $b, c \in T, a \in A, \alpha, \beta \in \Gamma$ implies $b \alpha c \beta a \in A$.

Note II.6 : A nonempty subset A of a ternary Γ -semiring T is a left ternary Γ -ideal of T if and only if A is additive subsemigroup of T and $T\Gamma T\Gamma A \subseteq A$.

Definition II.7 : A nonempty subset of a ternary Γ -semiring T is said to be a **lateral ternary Γ -ideal** of T if (1) $a, b \in A \Rightarrow a + b \in A$. (2) $b, c \in T, a \in A, \alpha, \beta \in \Gamma \Rightarrow b\alpha a\beta c \in A$.

Note II.8: A nonempty subset A of a ternary Γ -semiring T is a lateral ternary Γ -ideal of T if and only if A is additive subsemigroup of T and $T\Gamma A\Gamma T \subseteq A$.

Definition II.9 : A nonempty subset A of a ternary Γ -semiring T is a **right ternary Γ -ideal** of T if (1) $a, b \in A \Rightarrow a + b \in A$. (2) $b, c \in T, a \in A, \alpha, \beta \in \Gamma \Rightarrow a\alpha b\beta c \in A$.

Note II.10: A nonempty subset A of a ternary Γ -semiring T is a right ternary Γ -ideal of T if and only if A is additive subsemigroup of T and $A\Gamma T\Gamma T \subseteq A$.

Definition II.11: A nonempty subset A of a ternary Γ -semiring T is said to be **ternary Γ -ideal** of T if

(1) $a, b \in A \Rightarrow a + b \in A$

(2) $b, c \in T, a \in A, \alpha, \beta \in \Gamma \Rightarrow b\alpha c\beta a \in A, b\alpha a\beta c \in A, a\alpha b\beta c \in A$.

Note II.12 : A nonempty subset A of a ternary Γ -semiring T is a ternary Γ -ideal of T if and only if it is left ternary Γ -ideal, lateral ternary Γ -ideal and right ternary Γ -ideal of T .

Definition II.13 : A ternary Γ -semiring T is said to be **commutative ternary Γ -semiring** provided $a\Gamma b\Gamma c = b\Gamma c\Gamma a = c\Gamma a\Gamma b = b\Gamma a\Gamma c = c\Gamma b\Gamma a = a\Gamma c\Gamma b$ for all $a, b, c \in T$.

Definition II.14: An element a of a ternary Γ -semiring T is said to be an **identity** provided $a\alpha a\beta t = t\alpha a\beta a = a\alpha t\beta a = t\alpha t\beta a \forall t \in T, \alpha, \beta \in \Gamma$.

Note II.15 : An identity element of a ternary Γ -semiring T is also called as **unital element**.

Note II.16 : From this onwards T will denote a ternary Γ -semiring with an absorbing zero and a unit element 1 unless otherwise stated.

Theorem II.17 : The nonempty intersection of any family of lateral ternary Γ -ideals of a ternary Γ -semiring T is a lateral ternary Γ -ideal of T .

Theorem II.18 : The union of any family of lateral ternary Γ -ideals of a ternary Γ -semiring T is a lateral ternary Γ -ideal of T .

Definition II.19 : Let T be a ternary Γ -semiring and A be a non-empty subset of T . The smallest lateral ternary Γ -ideal of T containing A is called **lateral ternary Γ -ideal of T generated by A** .

Definition II.20 : A lateral ternary Γ -ideal A of a ternary Γ -semiring T is said to be the **principal lateral ternary Γ -ideal generated by a** if A is a lateral ternary Γ -ideal generated by $\{a\}$ for some $a \in T$. It is denoted by $M(a)$ (or) $\langle a \rangle_m$.

Theorem II.21 : The lateral ternary Γ -ideal of a ternary Γ -semiring T generated by a non-empty subset A is the intersection of all lateral ternary Γ -ideals of T containing A .

3. PRIME LATERAL TERNARY Γ -IDEAL

Definition III.1 : A lateral ternary Γ -ideal A of a ternary Γ -semiring T is said to be a **prime lateral ternary Γ -ideal** of T provided X, Y, Z are lateral ternary Γ -ideals of T and $X\Gamma Y\Gamma Z \subseteq A \Rightarrow X \subseteq A$ or $Y \subseteq A$ or $Z \subseteq A$.

Definition III.2 : A lateral ternary Γ -ideal A of a ternary Γ -semiring T is said to be **semiprime lateral ternary Γ -ideal** provided X is a lateral ternary Γ -ideal of T and $(X\Gamma)^{n-1}X \subseteq A$ for some odd natural number n implies $X \subseteq A$.

Theorem III.3 : A lateral ternary Γ -ideal P of T is a prime lateral ternary Γ -ideal of T if and only if $a\Gamma T\Gamma T\Gamma b\Gamma T\Gamma T\Gamma c \subseteq P$ implies $a \in P$ or $b \in P$ or $c \in P$, for any $a, b, c \in T$.

Proof: Suppose that P is a prime lateral ternary Γ -ideal of T . Let $a\Gamma T\Gamma T\Gamma b\Gamma T\Gamma T\Gamma c \subseteq P$, for $a, b, c \in T$. Then $T\Gamma a\Gamma T\Gamma T\Gamma b\Gamma T\Gamma T\Gamma c\Gamma T \subseteq P \Rightarrow (T\Gamma a\Gamma T)\Gamma(T\Gamma b\Gamma T)\Gamma(T\Gamma c\Gamma T) \subseteq P$. Since $T\Gamma a\Gamma T$, $T\Gamma b\Gamma T$ and $T\Gamma c\Gamma T$ are lateral ternary Γ -ideals of T , P is prime lateral ternary Γ -ideal of T . Therefore $T\Gamma a\Gamma T \subseteq P$ or $T\Gamma b\Gamma T \subseteq P$ or $T\Gamma c\Gamma T \subseteq P$ and hence $a \in P$ or $b \in P$ or $c \in P$.

Conversely suppose that P is a lateral ternary Γ -ideal such that $a\Gamma T\Gamma T\Gamma b\Gamma T\Gamma T\Gamma c \subseteq P$ implies $a \in P$ or $b \in P$ or $c \in P$. Let A, B and C are any three lateral ternary Γ -ideals of T such that $A\Gamma B\Gamma C \subseteq P$. Suppose if possible $A \not\subseteq P$, $B \not\subseteq P$, $C \not\subseteq P$. Then there exists a, b, c such that $a \in A$ and $a \notin P$, $b \in B$ and $b \notin P$ and $c \in C$ and $c \notin P$. $a \in A, b \in B, c \in C \Rightarrow a\Gamma b\Gamma c \subseteq A\Gamma B\Gamma C \subseteq P$. Now $a\Gamma T\Gamma T\Gamma b\Gamma T\Gamma T\Gamma c \subseteq A\Gamma B\Gamma C \subseteq P \Rightarrow a \in P$ or $b \in P$ or $c \in P$. It is a contradiction. Therefore $A \subseteq P$ or $B \subseteq P$ or $C \subseteq P$ and hence P is a prime lateral ternary Γ -ideal of T .

Theorem III.4 : A lateral ternary Γ -ideal P of T is a semiprime lateral ternary Γ -ideal of T if and only if $a\Gamma T\Gamma T\Gamma a\Gamma T\Gamma T\Gamma a \subseteq P$ implies $a \in P$ for any $a \in T$.

Proof: Similar to theorem 3.3.

Theorem III.5: If P is a prime lateral ternary Γ -ideal of a commutative ternary Γ -semiring T , then $(P:a) = \{x \in T / x\Gamma a\Gamma y \subseteq P \text{ for some } y \in T\}$ is also a prime lateral ternary Γ -ideal of T for any $a \in T \setminus P$.

Proof: Let P be a prime lateral ternary Γ -ideal of T and $(P:a) = \{x \in T / x\Gamma a\Gamma y \subseteq P \text{ for } y \in T\}$. Let $x, y \in (P:a)$. Therefore $x\Gamma a\Gamma x \subseteq P, y\Gamma a\Gamma y \subseteq P, x\Gamma a\Gamma y \subseteq P$ and $y\Gamma a\Gamma x \subseteq P$. $(x+y)\Gamma a\Gamma (x+y) = x\Gamma a\Gamma x + y\Gamma a\Gamma y + x\Gamma a\Gamma y + y\Gamma a\Gamma x \subseteq P \Rightarrow (x+y) \in (P:a)$. Let $x \in (P:a), s, t \in T$. Then $x\Gamma a\Gamma s \subseteq P, x\Gamma a\Gamma t \subseteq P \Rightarrow (s\Gamma x\Gamma t)\Gamma a\Gamma (s\Gamma x\Gamma t) = (x\Gamma a\Gamma s)\Gamma (x\Gamma a\Gamma t) \subseteq P$

$\Rightarrow s\Gamma x\Gamma t \subseteq P$ and hence $(P : a)$ is a lateral ternary Γ -ideal of T . Let A, B and C are any three lateral ternary Γ -ideals of T such that $A\Gamma B\Gamma C \subseteq (P : a)$, then $(A\Gamma B\Gamma C)\Gamma a\Gamma y \subseteq P$ and $A\Gamma a\Gamma y \subseteq P, B\Gamma a\Gamma y \subseteq P, C\Gamma a\Gamma y \subseteq P \Rightarrow A \subseteq (P : a)$ or $B \subseteq (P : a)$ or $C \subseteq (P : a)$. Therefore $(P : a)$ is a prime lateral ternary Γ -ideal of T .

Definition III.6: A lateral ternary Γ -ideal A of a ternary Γ -semiring T is said to be an **irreducible lateral ternary Γ -ideal** if $X \cap Y \cap Z = A$ implies $X = A$ or $Y = A$ or $Z = A$, for any lateral ternary Γ -ideals X, Y and Z of T .

Definition III.7 : A lateral ternary Γ -ideal A of a ternary Γ -semiring T is said to be a **strongly irreducible lateral ternary Γ -ideal** if $X \cap Y \cap Z = A$ implies $X \subseteq A$ or $Y \subseteq A$ or $Z \subseteq A$, for any lateral ternary Γ -ideals X, Y and Z of T .

Theorem III.8 : Every semiprime and strongly irreducible lateral ternary Γ -ideal is a prime lateral ternary Γ -ideal of T .

Proof: Let P be a strongly irreducible and a semiprime lateral ternary Γ -ideal of T . For any lateral ternary Γ -ideals A, B and C of T , $(A\Gamma B\Gamma C) \subseteq P. A \cap B \cap C$ is a lateral ternary Γ -ideal of T . Hence $(A \cap B \cap C)^3 = (A \cap B \cap C)\Gamma(A \cap B \cap C)\Gamma(A \cap B \cap C) \subseteq A\Gamma B\Gamma C \subseteq P$. By P is a semiprime lateral ternary Γ -ideal, $A \cap B \cap C \subseteq P$. Therefore $A \subseteq P$ or $B \subseteq P$ or $C \subseteq P$, since P is a strongly irreducible lateral ternary Γ -ideal. Thus P is a prime lateral ternary Γ -ideal of T .

Definition III.9 : A proper lateral ternary Γ -ideal A of a ternary Γ -semiring T is said to be a **maximal lateral ternary Γ -ideal** if there does not exist any other proper lateral ternary Γ -ideal of T containing A properly.

Theorem III.10: Any maximal lateral ternary Γ -ideal of T is a prime lateral ternary Γ -ideal.

Proof: Let M be any maximal lateral ternary Γ -ideal of T . To show that M is a prime let $a\Gamma T\Gamma T\Gamma b\Gamma T\Gamma T\Gamma c \subseteq M$. Suppose that $a, b \notin M$. $T\Gamma a\Gamma T\Gamma T\Gamma b\Gamma T$ is a lateral ternary Γ -ideal of T which contains a, b . By M is a maximal

lateral ternary Γ -ideal, $M + T\Gamma a\Gamma T\Gamma T\Gamma b\Gamma T = T$. As $1 \in T, 1 = m + \sum_{i=1}^n s_i \alpha_i a \beta_i t_i \delta_i x_i \gamma_i b \varepsilon_i y_i$, then

$$1\alpha c\beta c = (m + \sum_{i=1}^n s_i \alpha_i a \beta_i t_i \delta_i x_i \gamma_i b \varepsilon_i y_i) \alpha c \beta c \subseteq M + T\Gamma a\Gamma T\Gamma T\Gamma b\Gamma T\Gamma T\Gamma c\Gamma c \subseteq M + a\Gamma T\Gamma T\Gamma b\Gamma T\Gamma T\Gamma c \subseteq M.$$

Therefore $c \in M$. Hence M is a prime lateral ternary Γ -ideal.

Theorem III.11: If L is a lateral ternary Γ -ideal of T and a is a nonzero element of T such that $a \notin L$, then there exists an irreducible lateral ternary Γ -ideal P of T such that $L \subseteq P$ and $a \notin P$.

Proof: Let $\mathfrak{L}$ be the family of all lateral ternary Γ -ideals of T containing L and not containing an element a . Then $\mathfrak{L}$ is nonempty as $L \in \mathfrak{L}$. This family of all lateral ternary Γ -ideals of T forms a partially ordered set under inclusion. Hence by Zorn's lemma there exists a maximal lateral ternary Γ -ideal P in $\mathfrak{L}$. Therefore $L \subseteq P$ and $a \notin P$. Now, to show that P is an irreducible lateral ternary Γ -ideal of T , let A, B and C be any three lateral ternary Γ -ideals of T such that $A \cap B \cap C = P$. Suppose that A, B and C are contained in P properly. Since P is a maximal lateral ternary Γ -ideal in $\mathfrak{L}$, we get $a \in A, a \in B$ and $a \in C$. Therefore $a \in A \cap B \cap C = P$ which is an absurd. Thus, either $A = P$ or $B = P$ or $C = P$. Therefore, P is an irreducible lateral ternary Γ -ideal of T .

Theorem III.12: Any proper lateral ternary Γ -ideal of T is the intersection of irreducible lateral ternary Γ -ideal of T which contain it.

Proof: Let L be any proper ternary Γ -ideal of T and $\{A_\alpha\}_{\alpha \in \Delta}$ be a family of irreducible lateral ternary Γ -ideals of T which contain L , where Δ denotes the indexed set. Then clearly $L \subseteq \bigcap_{\alpha \in \Delta} A_\alpha$. To show $\bigcap_{\alpha \in \Delta} A_\alpha \subseteq L$.

Suppose that $\bigcap_{\alpha \in \Delta} A_\alpha \subset L$. Therefore, there is an element $a \in \bigcap_{\alpha \in \Delta} A_\alpha$ such that $a \notin L$. Then by the theorem III.11, there exist an irreducible ternary Γ -ideal P such that $L \subseteq P$ and $a \notin P$. This establishes the existence of irreducible lateral ternary Γ -ideal P such that $a \notin P$ and $L \subseteq P$. Therefore $a \notin \bigcap_{\alpha \in \Delta} A_\alpha$ for every $a \notin L$. Hence, by

the contra positive method $\bigcap_{\alpha \in \Delta} A_\alpha \subseteq L$. Therefore $\bigcap_{\alpha \in \Delta} A_\alpha = L$.

III. Conclusion

In this paper mainly we studied about lateral ternary Γ -ideals in ternary Γ -semirings.

IV. References

- [1] A. Gangadhara Rao, A. Anjaneyulu, D. Madhusudhana Rao-Prime Γ -ideals in Duo Γ -semigroups-International eJournal of Mathematics and Engineering 174 (2012) 1642-1653.
- [2] D. Madhusudhana Rao, A. Anjaneyulu and A. Gangadhara Rao-Prime Γ -Radicals in Γ -semigroup- International eJournal of Mathematics and Engineering 138 (2011) 1250-1259.
- [3] T. K. Dutta and S. Kar, On Regular Ternary Semirings, Advances in Algebra, Proceedings of the ICM Satellite Conference in Algebra and Related Topics, World Scientific(2003), 343-355.
- [4] T. K. Dutta and S. Kar, On Prime Ideals And Prime Radical of Ternary Semirings, Bull. Cal. Math. Soc., 97(5)(2005), 445-454.

- [5] T. K. Dutta and S. Kar, *On Semiprime Ideals And Irreducible Ideals Of Ternary Semirings*, Bull. Cal. Math. Soc., 97(5)(2005), 467-476.
- [6] T. K. Dutta and S. Kar, *On Ternary Semifields*, Discussiones Mathematicae – General Algebra and Applications, 24(2)(2004), 185-198.
- [7] T. K. Dutta and S. Kar, *On The Jacobson Radical of A Ternary Semiring*, Southeast Asian Bulletin of Mathematics, 28(1)(2004), 1-13.
- [8] T. K. Dutta and S. Kar, *A Note On The Jacobson Radical of a Ternary Semiring*, Southeast Asian Bulletin of Mathematics, 29(2)(2005), 321-331.
- [9] T. K. Dutta and S. Kar, *Two Types of Jacobson Radicals of Ternary Semirings*, Southeast Asian Bulletin of Mathematics, 29(4)(2005), 677-687.
- [10] S. N. Il'in, *Regularity Criterion for Complete Matrix Semirings*, Mathematical Notes, 70(3)(2001), 329-336. (Translated from Matematicheskii Zametki, 70(3)(2001), 366-374).
- [11] D. H. Lehmer, *A ternary analogue of abelian groups*, American Journal of Mathematics, 59(1932), 329-338.
- [12] W. G. Lister, *Ternary Rings*, Trans. Amer. Math. Soc., 154(1971), 37-55.
- [13] J. Los, *On the extending of models I*, Fundamenta Mathematicae, 42(1955), 38-54.
- [14] M. L. Santiago, *Some contributions to the study of ternary semigroups and semiheaps*, (Ph.D. Thesis, 1983, University of Madras).
- [15] VB Subramanyeswara Rao, A. Anjaneyulu, D. Madhusudhana Rao, *Po- Γ -ideals in Po- Γ -semigroups*-International Organization Scientific Research Journal of Mathematics (IOSR-JM) ISSN: 2278-5728 Volume 1, Issue 6 (July-Aug 2012), pp 39-51.

Acknowledgments

Our thanks to the experts who have contributed towards preparation and development of the paper and learned referee for his valuable suggestions for improvement of the paper.

AUTHORS'S BRIEF BIOGRAPHY:

²Dr. D. Madhusudhana Rao: He completed his M.Sc. from Osmania University, Hyderabad, Telangana, India. M. Phil. from M. K. University, Madurai, Tamil Nadu, India. Ph. D. from Acharya Nagarjuna University, Andhra Pradesh, India. He joined as Lecturer in Mathematics, in the department of Mathematics, VSR & NVR College, Tenali, A. P. India in the year 1997, after that he promoted as Head, Department of Mathematics, VSR & NVR College, Tenali. He helped more than 5 Ph. D's. At present he is guiding 7 Ph. D. Scholars and 3 M. Phil., Scholars in the department of Mathematics, Acharya Nagarjuna University, Nagarjuna Nagar, Guntur, A. P.

A major part of his research work has been devoted to the use of semigroups, Gamma semigroups, duo gamma semigroups, partially ordered gamma semigroups and ternary semigroups, Gamma semirings and ternary semirings, Near rings ect. He is acting as peer review member to (1) "British Journal of Mathematics & Computer Science", (2) "International Journal of Mathematics and Computer Applications Research", (3) "Journal of Advances in Mathematics" and Editorial Board Member of (4) "International Journal of New Technology and Research". He is life member of (1) Andhra Pradesh Society for Mathematical Sciences, (2) Heath Awareness Research Institution Technology Association, (3) Asian Council of Science Editors, Membership No: 91.7347, (4) Council for Innovative Research for Journal of Advances in Mathematics". He published more than 68 research papers in different International Journals to his credit in the last four academic years.

¹Mrs. M. Sajani Lavanya: She completed her M.Sc. from Hindu College, Guntur, under the jurisdiction of Acharya Nagarjuna University, Guntur, Andhra Pradesh, India. She joined as lecturer in Mathematics, in the department of Mathematics, A. C. College, Guntur, Andhra Pradesh, India in the year 1998. At present she pursuing Ph.D. under guidance of Dr. D. Mathusudhana Rao, Head, Department of Mathematics, VSR & NVR College, Tenali, Guntur(Dt), A.P. India in Acharya Nagarjuna University. Her areas of interests are ternary semirings, ordered ternary semirings, semirings and topology. Presently she is working on Ternary Γ -Semirings.

³Mr. V. Syam Julius Rajendra: He completed his M.Sc. from Madras Christian College, under the jurisdiction of University of Madras, Chennai, Tamilnadu. After that he did his M.Phil. from M. K. University, Madurai, Tamilnadu, India. He joined as lecturer in Mathematics, in the department of Mathematics, A. C. College, Guntur, Andhra Pradesh, India in the year 1998. At present he is pursuing Ph.D. under guidance of Dr. D. Mathusudhana Rao, Head, Department of Mathematics, VSR & NVR College, Tenali, Guntur(Dt), A.P. India in Acharya Nagarjuna University. His area of interests are ternary semirings, ordered ternary semirings, semirings and topology. Presently he is working on Partially Ordered Ternary Γ -Semirings.