Involution on rings

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ABSTRACT

This paper deals with the concept of involution rings, involution ring properties and some important results and we discussed some important results in simple rings, minimal and maximal ideals with involution.

I. INTRODUCTION

Definition 1.1. An involution on ring R is a unary operation $*$ on R $(a^*)^* = a$, $(a+b)^* = a^* + b^*$ and $(ab)^* = b^* a^*$ for each $a, b \in R$. A ring with this operation is called a ring with involution or $*$-ring.

Definition 1.2. Let R be a $*$-rings and let I be an ideal of a ring R. Then I is a $*$-ideal if I^* is sub set of I. Here we define for any non empty set S, we define $S^* = \{s^* : s \in S\}$.

Definition 1.3. A non zero ideal I of an involution ring R which is closed under involution is termed as $*$-ideal. That is $I^* = \{a^* \in R | a \in I\} \subseteq I$.

Definition 1.4. A sub ring A of R is said to be a bi-ideal of R if $ARA \subseteq A$ and a $*$-bi ideal if in addition it is closed under involution of R.

Example let S be a ring and let X be an ideal of S with $X^2 = 0$. Let $R = \begin{pmatrix} S & X \\ X & S \end{pmatrix}$ then with the standard matrix operation R is a ring and a matrix transposition is an involution, denoted by $*$. If S has a unity, then $R^2 = R$. If X is a minimal ideal of S, then $X = \begin{pmatrix} 0 & X \\ 0 & 0 \end{pmatrix}$ is a minimal ideal of R.

Definition 1.5. $(S, +, \cdot)$ is a semi-ring (a structure in which $(S, +)$ is a commutative semi group, $(S, \cdot)$ is a semi group, and distributes over $+$) then $(S, +, \cdot)$ is called an involution semi ring provided that $*$ is

an involution of S satisfying the identities $(x+y)^* = x^* + y^*, (xy)^* = y^* x^*$

Sometimes, semi ring may be equipped with a zero, and or an identities one. In such a case we require that the involution of satisfies $0^* = 0$ and $1^* = 1$.

Definition 1.6. A right (left) ideals of I^* in a ring R is called $*$-minimal ideals if

i. $I^* \neq (0)^*$ and
ii. If I^* is a non zero (right/left) ideal of a ring R with involution contained in I^* then $I^* = J^*$.

Definition 1.7. For a $*$-ring R the direct sum of all minimal $*$-ideal is denoted by $Soc^*(R)$, the $*$-socle of R. (if R has no $*$-minimal ideals then define $Soc^*(R)$ to be zero) and also we have $Soc^*(R)$ is the sub set of $Soc(R)$.

Definition 1.8. We say R is $*$-simple R has no non zero proper ideals.

Definition 1.9. An ideal A^* is said to be maximal ideals of the ring R with involution $*$, if

i. $A^* \neq R^*$
ii. For any ideals B^* is a sub set of A^*, either $B^* = A^*$ or $B^* = R^*$

Definition 1.10. Let R be a ring with involution. For some $a \in R$, one may write

Rings With Involution

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   Rings with Involution I. N. Herstein,1976   *Algebraic Conditions on Rings with Involution and Some Generalizations of the Center of a Ring* Antonino Giambruno,1977   *Certain Aspects of Rings with Involution* I. N. Herstein,1967   **Rings with Involution** Keith E. Mellinger,1995   <u>The Book of Involutions</u> Max-Albert Knus,1998-06-30 This monograph is an exposition of the theory of central simple algebras with involution in relation to linear algebraic groups It provides the algebra theoretic foundations for much of the recent work on linear algebraic groups over arbitrary fields Involutions are viewed as twisted forms of hermitian quadrics leading to new developments on the model of the algebraic theory of quadratic forms In addition to classical groups phenomena related to triality are also discussed as well as groups of type F_4 or G_2 arising from exceptional Jordan or composition algebras Several results and notions appear here for the first time notably the discriminant algebra of an algebra with unitary involution and the algebra theoretic counterpart to linear groups of type D_4 This volume also contains a Bibliography and Index Features original material not in print elsewhere a comprehensive discussion of algebra theoretic and group theoretic aspects extensive notes that give historical perspective and a survey on the literature rational methods that allow possible generalization to more general base rings   **Rings and Nearrings** Mikhail Chebotar,Yuen Fong,Weng-Fong Ke,Pjek-Hwee Lee,2011-12-22 This volume consists of seven papers related in various matters to the research work of Kostia Beidar a distinguished ring theorist and professor of National Ching Kung University NCKU Written by leading experts in these areas the papers also emphasize important applications to other fields of mathematics Most papers are based on talks that were presented at the memorial conference which was held in March 2005 at NCKU   **Differential Identities in Rings and Algebras and their Applications** Shakir Ali,Mohammad Ashraf,Vincenzo De Filippis,Lahcen Oukhtite,Nadeem Ur Rehman,2025-05-26 The theory of differential identities in associative rings and algebras is the basis of this monograph Informally an identical relation involving arbitrary elements in the underlying rings or algebras along with the unknown differential function is called a differential identity in a ring or algebra Invariant theory non commutative geometry mathematical physics and the theory of rings and algebras are just a few of the fields where this abstract theory has proved to be an effective instrument for solving a wide range of challenging issues and as the twenty first century has arrived the theory of differential identities has found enormous applications in resolving a number of unresolved problems in the theory of rings This volume summarizes the findings and approaches that have significantly advanced the field during the previous three decades The first chapter provides a brief introduction to the topic The following three chapters cover the various kinds of derivations in rings and algebras as well as the interactions between the structure of some classes of rings with involution and the behavior of the underlying derivations generalized derivations skew derivations and b generalized derivations as well as their corresponding properties Chapter 5 explores the characterization of several kinds of higher derivable mappings and the structure of Lie and Jordan type higher derivations

Although the book contains numerous applications of the conclusions presented in these chapters the last chapter mostly focuses on the application of derivations This research monograph is useful for researchers working in the area of differential identities in rings and algebras It provides a comprehensive and authoritative account of research findings **Polynomial Identities in Ring Theory** ,1980-07-24 Polynomial Identities in Ring Theory Rings with Involution Mark Aronovich Naĭmark,1950 **Simplicity Conditions in Rings with Involution** Nadine Carol Myers,1971 **Topological Rings Satisfying Compactness Conditions** M. Ursul,2012-12-06 Introduction In the last few years a few monographs dedicated to the theory of topolog ical rings have appeared Warn27 Warn26 Wies 19 Wies 20 ArnGM Ring theory can be viewed as a particular case of Z algebras Many general results true for rings can be extended to algebras over commutative rings In topological algebra the structure theory for two classes of topological algebras is well developed Banach algebras and locally compact rings The theory of Banach algebras uses results of Banach spaces and the theory of locally compact rings uses the theory of LCA groups As far as the author knows the first papers on the theory of locally compact rings were Pontr1 J1 J2 JT An lOt K1 K2 K3 K4 K5 K6 Later two papers GS1 GS2 appeared which contain many results concerning locally compact rings This book can be used in two w ays It contains all necessary elementary results from the theory of topological groups and rings In order to read these parts of the book the reader needs to know only elementary facts from the theories of groups rings modules topology The book consists of two parts **Cogroups and Co-rings in Categories of Associative Rings** George M. Bergman,Adam O. Hausknecht,1996 This book studies representable functors among well known varieties of algebras All such functors from associative rings over a fixed ring R to each of the categories of abelian groups associative rings Lie rings and to several others are determined Results are also obtained on representable functors on varieties of groups semigroups commutative rings and Lie algebras The book includes a Symbol index which serves as a glossary of symbols used and a list of the pages where the topics so symbolized are treated and a Word and phrase index The authors have strived and succeeded in creating a volume that is very user friendly *Quadratic and Hermitian Forms over Rings* Max-Albert Knus,2012-12-06 From its birth in Babylon till 1936 the theory of quadratic forms dealt almost exclusively with forms over the real field the complex field or the ring of integers Only as late as 1937 were the foundations of a theory over an arbitrary field laid This was in a famous paper by Ernst Witt Still too early apparently because it took another 25 years for the ideas of Witt to be pursued notably by Albrecht Pfister and expanded into a full branch of algebra Around 1960 the development of algebraic topology and algebraic K theory led to the study of quadratic forms over commutative rings and hermitian forms over rings with involutions Not surprisingly in this more general setting algebraic K theory plays the role that linear algebra plays in the case of fields This book exposes the theory of quadratic and hermitian forms over rings in a very general setting It avoids as far as possible any restriction on the characteristic and takes full advantage of the functorial aspects of the theory The advantage of doing so is not only aesthetical on the one hand some classical proofs gain in

simplicity and transparency the most notable examples being the results on low dimensional spinor groups on the other hand new results are obtained which went unnoticed even for fields as in the case of involutions on 16 dimensional central simple algebras The first chapter gives an introduction to the basic definitions and properties of hermitian forms which are used throughout the book   Radical Theory of Rings J.W. Gardner,R. Wiegandt,2003-11-19 Radical Theory of Rings distills the most noteworthy present day theoretical topics gives a unified account of the classical structure theorems for rings and deepens understanding of key aspects of ring theory via ring and radical constructions Assimilating radical theory s evolution in the decades since the last major work on rings and radicals was published the authors deal with some distinctive features of the radical theory of nonassociative rings associative rings with involution and near rings Written in clear algebraic terms by globally acknowledged authorities the presentation includes more than 500 landmark and up to date references providing direction for further research   **Rings with Generalized Identities** Konstant I. Beidar,Wallace S. Martindale,Alexander V. Mikhalev,1995-11-17 Discusses the latest results concerning the area of noncommutative ring theory known as the theory of generalized identities GIs detailing Kharchenko s results on GIs in prime rings Chuang s extension to antiautomorphisms and the use of the Beidar Mikhalev theory of orthogonal completion in the semiprime case Provides novel proofs of existing results   **On some additive mappings in rings with involution and related results** Matej Brešar,Joso Vukman,1988   *Canadian Journal of Mathematics* ,1974-08   **Ring and Module Theory** Toma Albu,Gary F. Birkenmeier,Ali Erdogan,Adnan Tercan,2011-02-04 This book is a collection of invited papers and articles many presented at the 2008 International Conference on Ring and Module Theory The papers explore the latest in various areas of algebra including ring theory module theory and commutative algebra   Ring Theory V1 ,1988-06-01 Ring Theory V1   **On the Study of Varieties of Rings with Involution** Tiwadee Musunthia,2010

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