CCOST SPONSORED PROJECT

Project title: "A STUDY OF DUAL CONCEPTS IN MODULES IN ALGEBRA"

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SUMMARY:

Algebraic structures play an important role in Mathematics with applications in many areas such as theoretical physics, computer sciences, control engineering, information science and coding theory etc. Study of different algebraic structures is an outstanding area of research field. Researchers are eager to create connection in relevant fields of research with pure adaptation. Enormous numbers of research publications ensure the utility of these types of quality structures. The enhancement of firm algebraic structures in generalized form entertains its entity entirely. This optimal trend of research obviates gradually the study of nature and makes massive bridge between human being with nature.

In the study of modules in Algebra, one often comes across the concepts and propositions, which are dual in nature. By the word "Dual concepts" we mean to say that if S is a statement about a class of modules and module homomorphisms then its dual S* is the statement about the same class of modules and module homomorphisms obtained by reversing the direction of each module homomorphism and replacing each composite $\alpha o \beta$ of module homomorphism by $\beta o \alpha$. Though it is not true that the dual of a proposition must be a proposition but if it happens to be true, more often that the proofs of each of them are dual. A number of dual concepts and pairs of dual modules have emerged so far still; a lot is being done and can be done in this field.

We have explored and designed some of the dual pairs of modules from a homological point of view. In the starting, the concept of module code and some related results has been given and the applications of module structure of algebra in coding theory in different branches of engineering have been shown. After that, we have investigated some properties of weakly pure submodules of multiplication modules. We have introduced the concept weakly co-pure submodule of multiplication modules, which is the dual notion of weakly pure submodule of multiplication modules and investigated some properties of weakly pure and co-pure submodules of multiplication modules. Some results on weak multiplication modules have been given. We obtained some results on weak co-multiplication modules. Some results have been given on prime sub modules in weak multiplication modules. By taking the notion of weak multiplication modules over a commutative ring with identity, we have defined the notion of product to two submodules of weak multiplication modules and we have applied this notion to characterize the prime submodules in weak multiplication modules. We have discussed some remarks on prime submodules in weak co-multiplication modules. We also studied the concept locally multiplication modules and introduced the concept of locally co-multiplication module. In addition, we obtained some properties of locally co-multiplication modules.

From the point of view of applicability of the knowledge, it is important here to note that in the development of modern science and technology, homological algebra play a vital role. To mention few important application of algebra we observe that group theory, group characters and group representations find their application in cryptography coding decoding, X-ray crystallography, problems of energy levels and other places in physics as well as in chemistry. The Homological algebra finds its applications in laser technology and quantum mechanics in physics. The aim this project was to study the above-mentioned topic or the other dual pairs from a point of view of a mathematician.

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