1. INTRODUCTION

1.1 General

Tamil has rich literary and grammatical tradition dating back to many centuries before Christ. Today Tamil is used in various domains like science, technology, administration, education, law, politics, religion etc. With reference to science many writings are coming in Tamil and hence Tamil receives the fourth dimension besides the already existing dimensions, namely, iyal (common language), icai (musical language) and naːtakam (language of drama).

Tamil is being introduced as a subject and as a medium of instruction starting from primary education to collegiate education and as a language of administration due to the efforts of the government of Tamil Nadu. People were engaged to write books and articles in science, technology and medicine making use of Tamil and as a result of this many texts are coming up in Tamil either by way of creation or by way of translation. Since many people are involved in writing science through Tamil as a measure to modernize Tamil and to enhance its use in different domains, variations appear in science writings. These variations could be observed both in technical term and discourse.
This state of flux and variation leads to the identification and application of methods of standardizing science vocabulary and discourse and science writing in general so that science writings in Tamil could be used in a homogeneous pattern in different domains of general use.

1.2 Translation

Translation is one of the methods through which information related to science is brought to Tamil. Translation in general involves the process of identifying semantic, functional and formal equivalents to the source language items in the target language in such a way that the genius of the target language is not impaired. The item of source language which are subjected to translation may be words, sentences and texts. Translation is a process of substituting equivalents and this process makes use of some principles and procedures which may show variation due to the materials selected for translation, the domain, from which materials can be drawn, the purpose behind translation, the nature of the languages and the personalities involved in the translation process. Many theoretical discussions, methods, principles, procedures and types of translations have been put forth by many scholars (Catford (1965), Nida (1964), Newmark (1981) and Thirumalai (1979)).
Translation of source language materials can be made in an aesthetic way as one does it with reference to literature or in an utilitarian way as one does it with reference to science, technology, law, etc. Translation process brings new materials and ideas into the target language and hence translation acts as an agent for information transfer among languages (Thirumalai, 1979). Depending upon the materials chosen for translation, the method of translation will vary. For instance, the way in which science materials are translated will be different from the way in which literary or religious materials are translated.

1.2.1. Scientific translation Vs literary translation

Some of the differences, for example, between science and literary translation can be summarized in the following way. Science translation gives importance to the materials that are translated. It does not bother about the preservation or evoking of aesthetic sensibility of the reader. It is highly formal in nature. Literary translation, on the other hand, gives importance both to the nature and method of translation. It takes care of preserving and evoking the aesthetic sensibility of the reader. It is stylistic in nature and follows the registeral aspects of the target language into considerations.
As far as possible, during science translation variation will be avoided whereas in literary translation version and variation are allowed to take care of readers' response. In science, translation problems may arise due to non availability of the technical term equivalent to the technical terms. There is also constraint of not using paraphrase in the place of technical terms. For example, the word 'electron' may not have an equivalent term in Tamil language; in that case the term is transliterated in Tamil graphological form. This strategy helps in avoiding confusion of terms and in maintaining the universal usages in the target language. By this method foreign technical words are made familiar in target language in the course of time.

Science translation is simpler when compared to literary translation and it avoids redundant and stylistic features. Moreover, the information is found in the source language science material is preserved in precise and intelligible form according to the standards of the target language. Very often science translation makes use of fresh and new texts representing new scientific discovery.
Literary translation gives importance to the preservation of emotive and stylistic elements of the texts. The elements contributing to the enhancement of literary value are as far as possible preserved during translation.

1.3 Science

The Latin word 'scientia' meant 'knowledge', 'scientific' knowledge is extremely diverse, extending from subatomic reactions to mental processes. Science is always developing and is not a static body of knowledge. Scientific knowledge is defined as a cumulative body of systematized knowledge gained by observation, experiment and reasoning. Such knowledge may, as pure science, be built upon self-evident truths or as natural or physical science, be based upon observation and experiment within the empirical method (The new college Encyclopaedia, 1978).

1.3.1 Language of Science

Language of science is not different from general language because it shares all the characteristic features of general language. The language of science is easily identified because it adopts direct and straightforward way of expressing scientific facts. Language of science is a domain sensitive language and it is used predominantly to
define, describe, explain, evaluate and to verify empirical facts. Units of the language of science should avoid the vagueness in meaning. The terms of scientific language are expected to be precise, quantitative and operationally definable. Science language existing in written mode has a large number of paralinguistic features like symbols, equations, tables, charts, diagrams, etc. It has very limited number of aesthetic and stylistic expressions. (Thirumalai, 1979).

1.4 Scientific Tamil

The term 'Scientific Tamil' refers to the Tamil used in the realm of science. In the mid nineteenth century onwards reviving attempts were made to modernize the use of Tamil language for writing science. Modernization of Tamil for science is made possible through the processes of lexical borrowing, elaboration and creation of technical terms and discourse. Evolving sentence structures to write articles and textbooks on various science topics and themes is also involved in modernization. Standardization of Tamil is also felt for establishing standard technical terms and units, and rhetorical functions of science writings.

When the idea of using Tamil for the purpose of
representing scientific information arose, creation of technical terms, phrases and other constructions which are impersonal was kept as one of the main focuses of attention. As a consequence of this, various strategies of creating technical terminologies related to science and technology such as transliteration, translation, partial translation, loan blending, new coinages were adopted (Radha Chellappan, 1982). Also proposals were made regarding the nature of the syntactic constructions to be created in Tamil for writing science. (Sundaram, 1986). Due to the development and impact of discourse analysis and the researches on language for special purpose like ESP, EST, Tamil linguists showed interest in analysing the discourse patterns that are required for communicating science and technology through Tamil language (Karunakaran and Shunmugom, 1989).

1.4.1 Creation of technical terms in Tamil

Creation of technical terms is one of the important aspects involved in developing any language for science. A technical term is a domain-based vocabulary created for referring to the objects, processes, event, action, etc., figuring in the technical domain. Languages under the threshold of developing scientific register are involved in the creation of technical terms. Technical term creation is
made possible through adoption of terms from Dravidian languages, use of archaic terms with or without modification, semantic extension of some native vocabulary items, etc. This involves careful use of all word formation processes like derivation, compounding, etc.

1.4.2 Scientific technical terms in Tamil

1.4.2.1 Word

In written texts words are separated from one another by spaces. A linguistic unit that occurs in between spaces in a printed text is considered as a word. A word is assumed to be made up of a sequence of sounds in speech or as a sequence of letters in writing. Native speakers of any language are capable of recognizing words found in utterances. When they are asked to pronounce the utterance slowly, they introduce gaps in between words. Word is a psychological reality and word recognition is an intuitive strategy.

Bloomfield (1933) defines word as a minimum free form. Forms which never occur alone as whole forms are called as bound forms and forms which may occur alone are called as free forms. Any free form, no part of which is itself a free form, is treated as a word.
Potential pause, use of a single speech melody, and segmentability are the three criteria generally proposed in order to recognize or identify a stretch of sounds as a single word.

Two other criteria that are used to define the word are mobility and uninterruptibility. One of the characteristic features of a word is that it tends to be internally stable in terms of the order of its constituent morphemes. A word is also mobile, since it is permutable sometimes to other positions in the same sentence. We mean by uninterruptibility, the possibility of not inserting other elements between the constituents of a word.

1.4.2.2 Technical term

A technical term is a specialized vocabulary item created for the representation of concepts related to the scientific objects, processes, quality, etc. It is an efficient and explicit form referring to technical concepts. Sometimes technical terms are created in a language by extending the existing words of a natural language to the scientific and technical domain. A technical term may be a word or a phrase with reference to its structure and may belong to different grammatical categories like noun or verb.
A technical term gets its meaning fixed by agreement and definition, and receives qualities like objectivity and adoptability. Technical terms are expected to have the qualities like brevity, unambiguity, accuracy, meaningfulness, simplicity, euphony, international usage and derivational susceptibility. A term is normally created after the identification of a concept. Identification of a concept involves demarcation of its referential boundaries and the components that go into the making of that concept. Creation, translation, coining of technical terms should be in accordance with the identification of concepts and correlating those concepts with names. A technical term may be a noun, a verb, an adjective or even an adverb and this is decided upon the way a term is used in sentence context. (Thirumalai, 1979).

1.4.3 Nativization

Nativization of technical terms is one of the processes involved in enriching the technical term in a target language based on the model of source language. Nativization will occur through different means after borrowing lexical items from different source languages. Nativizing borrowed lexical elements is brought about through transcription and translation. Reviving archaic usages
and/or extending the range of lexical usages to refer to concepts, method of science are also followed in the creation of terms besides nativization of borrowed terms. Since Tamil language is at the threshold of creating science terms and discourses it naturally borrows and adopts terms and styles from other languages and nativizes them without violating the linguistic genius, social values related to the Tamil language and society (Radha Chellappan*, 1982).

1.4.4 Standardization of technical terms in Tamil

Developing a language with a view to make it susceptible to express and organise the scientific concepts and developments appearing in the world of science is a telescoping activity and it is also considered as a part of the modernisation process. Tamil language experts are also interested in developing a scientific register so as to describe, define and classify experimental reality appearing in the modern scientific world. Due to the interest in the modernisation of Tamil for science, many scientists and language specialists are involved in the process of creating and translating technical terminologies at a high speed and without following strict standardization principles. As a consequence of this effort, many variant forms appear for one and the same technical term. Eventhough multiplicity
and variation are sources for enrichment of vocabulary, it is felt that scientific vocabulary should be homogeneous and invariant with reference to meaning and interpretation. This will safeguard the reflection of scientific vigour in technical terms and the terms will become highly objective. The state of the existence of variants develops the need for standardizing the technical vocabulary in Tamil.

Standardization process and techniques are part of the language planning activity and they should be carried out keeping in mind the attitude, norms and value of the society. Standardization of technical terms is also carried out in a planned manner keeping in mind the factors such as adaptability, economy, uniformity, appropriateness, interdisciplinary perspectives, and language purity, etc. That these factors operate in the naturalistic or planned form in the standardization process is evident through several studies on standardization made in general and with special reference to Tamil (Ray, 1963; Radha Chellappan, 1986; Meenakshisundram, 1990).

1.5 The present study

1.5.1 Aim of the present study

The main aim of the present study is to collect the Tamil technical terms and discourse patterns found in the
domain of physics particularly in higher secondary physics text books. These technical terms and discourse patterns will be reviewed with a view to identify the variations in them. Variations in the use of technical term and discourse pattern may occur due to many reasons. Lack of proper technical terms, the activity of creating technical terms by different people involved in scientific writing, the target of maintaining idiosyncrasy on the part of science writers in creating, and translating technical terms and discourse pattern, etc., play a role in bringing variations in technical term and discourse pattern in Tamil science writings. Sociolinguistic principles will then be applied so as to make standardization of technical terms.

The process of standardization, involves the use of several principles and procedures and these will have to be discussed so as to evolve standard technical terms in Tamil. The aim of the present research can be listed in the following manner:

1. Identifying translation equivalents in Tamil for technical terms belonging to the domain of physics.
2. Identifying the approaches adopted to arrive at the technical term equivalents in Tamil. Term
creation involves the use of transliteration, partial translation, translation etc. as strategies.

3. Identification of the mode of writing scientific discourse in Tamil.

4. Evolving and testing a model created for standardizing technical terms in Tamil.

5. Finding out the direction of technical term standardization in Tamil, in the present day context. Also making a review of the scientific terms that are standardized with or without strict planning process.

1.5.2 Scope of the present study

Translation can be approached from several perspectives. Translation may be analysed from the point of view of communication, minimum unit taken up for translation, the techniques adopted for translation etc., and so, there exists a wider scope for translation studies in any language. However, this study has restricted its scope to the analysis of the techniques employed by the translator in accomplishing the translation of scientific texts and terms.
The present study has taken up the physics text books in Tamil that are used in higher secondary schools curriculum of Tamil Nadu for the purpose of analysis. Specifically +2 physics text books are chosen for collecting data. The reason for choosing +2 level text book is that the syllabi for +2 science subjects have been revised completely recently and these text books have been produced incorporating the recent developments and modification made in +2 syllabi. Physics text books (Vol. I & Vol. II) have been chosen for study because in physics we find a large scale use of technical terms when compared to other fields of science. The problems involved in the translation of technical terms from English to Tamil, the problems of producing scientific discourse in Tamil and the issues related to the standardization process etc., have been given special attention in this study. This study is an attempt with a view to make an analysis of the problem of writing science through Tamil and to have a complete and comprehensive understanding of the issues related to science writing so as to propose certain steps to improve science writing and translation in Tamil.

1.5.3 Source/Data for the study

The data for the present research have been
collected primarily from the higher secondary physics text books which are used in English and Tamil media. All the technical terms both in English and Tamil have been collected from these text books. Mass media and college level physics text books have also been consulted and referred to some extent for the purpose of data collection. Moreover, different types of discourse materials related to definition, description, visual illustration etc have also been collected. From those data, limited number of technical terms were selected for the purpose of preparing questionnaires. These questionnaires were created with the objective of finding out variation in technical terms when technical terms are translated from English to Tamil. Based on the analysis of this data, another questionnaire was prepared with the purpose of assessing the standardization process and the factors involved for the standardisation of technical terms. This also forms the data for the present research. In total three kinds of data viz. (1) technical terms from written source (2) variation of terms and translation data elicited using the questionnaire and (3) data related to standarization have been collected and analysed.
1.5.4 Significance of the study

Translation, as used in the present day context, is an art of translating the message oral or written from one language to another. This process has attracted the attention of scholars and therefore new approaches to translation are coming up with different translation principles. Making use of these principles one and the same text can be translated in many ways. The present research can help one to understand the relative merits and demerits of different approaches to translation. In this sense this study gains its significance.

In this study written scientific discourse is taken for analysis and presentation. It deals with certain aspects of discourse to be adopted while creating scientific discourse of physics subject in Tamil. By studying the organisation of science discourse in Tamil, the possibilities of establishing Science register in Tamil writings can be proposed.

Apart from these two areas, standardization of technical terms receives attention in this present research. Standardization of technical terms gets greater significance in the present day context for achieving higher percentage of communication and transmission of message. This study
attempts to assess the extent to which and the way in which standardization has taken place in technical terms in Tamil. The impact obtained from the study will help in large scale standardization of Tamil terms and usages. In this way also this study gains significance.

1.5.5 Earlier studies

Translation plays an important role in the modern world. Numerous books and articles on translation have been written by specialists in all the fields. Translation studies are required in countries like India where multilingualism prevails. The Tamil language which was earlier considered to be inadequate for communicating science knowledge, is now accepted as reasonably developed to communicate scientific knowledge. Tamil is now proved to be a suitable medium for both communicating and popularising scientific knowledge, and for instructing science subjects. Tamil scholars are at the threshold of coining many technical terms and writing science through Tamil. Conflicting views were expressed by people while the matter of discussion, the suitability of Tamil for science education arose among scholars. This created an interest to trace the beginnings of the thought of using Tamil language for communicating scientific knowledge. It was learnt that a
poineering work was undertaken by Dr. Samuel Fisk Green of America.

Dr. Green mastered the Tamil language within a few years in Jaffna and tried to introduce Tamil as the medium of instruction of western medicine in his medical school. Today many writings are coming to popular science through Tamil and to give education in science to the student community in Tamil. Yet the objectivity that is required while writing science through Tamil is yet to be achieved. For this modernisation and standardisation of Tamil usage will be essential. (quoted in K. Meenakshi Sundaran, 1974).

1.5.6 Organization of the study

The present study has been reported in six chapters including the chapters introduction and conclusion. The bibliographical information and materials related to the sample interview schedule associated with the present study are added at the end of the dissertation. The organizational form of the six chapters is as follows:

Chapter-1: Introduction

In the introductory chapter, a general introduction about the concepts like, science, language of science
Science Tamil, science terms in Tamil, methods of creating Tamil forms and uses for science etc are given along with the aim, scope, significance of the present study. Also a description of the organization of the thesis is given in miniature form.

Chapter-2: Methodology

In this chapter, the methodologies employed in the preparation of questionnaire, sampling frame, selection of informants, selection of sample, data collection, data elicitation etc., are all explained.

Chapter-3: Translation equivalents in Tamil

This chapter exposes the concept of translation, theories of translation, types of translation, etc. and focuses on certain aspects of translation principles and procedures that are adopted by the Tamil science writers to translate the source language technical terms into Tamil. The underlying principles employed by the people involved in translating technical terms have been brought out and an attempt has been made to evaluate and findout whether such principles are appropriate and accurate. Suitable methodology was also suggested with reference to science writing in Tamil.
Chapter-4 : Science discourse in Tamil

This chapter introduces the nature of discourse study in general giving due importance to the definition, and theory, behind discourse analysis. The organization of science discourse is discussed in detail with emphasis given to discourse function with discourse rhetoric. Some problems encountered while creating scientific discourses in Tamil parallel to English science discourse are presented. How key words reflecting rhetorical function of science appear in Tamil is explained with illustration.

Chapter-5 : Standardization of technical terms in Tamil

This chapter gives general information about language planning and standardization. The possibility of applying standardization principles to the standardization of the technical term in Tamil is analysed. General principles like efficiency, commonality, acceptability etc., are discussed as factors behind standardization of terms. The processes involved in standardization of technical terms in Tamil are discussed.

Chapter-6 : Findings and Conclusions

In this concluding chapter, the finding and observations obtained through the present study are listed
The appendix presented includes the questionnaire used during the field work and the sample data collected.