PREFACE

The dielectric constant of a material is a measure of the ability to hold charge. The study of the properties of dielectrics and the dependence of dielectric constant on the composition and structure of the substance and on various external factors such as temperature, humidity, radiation effects, mechanical action, intensity and frequency of change of an electric field etc. has emerged as an important field of science. The non-ideal behaviour of liquid mixtures can also be characterized by the excess dielectric constant of the mixture along with other excess parameters.

No doubt, several investigators developed the techniques for the measurement of dielectric constant in different liquids and several manufacturers have produced a variety of instruments for dielectric constant measurement. But these are conventional and suffer from disadvantages. However, the attempts to design and develop the computer-based systems for measurement of dielectric constant in liquids are rather scarce particularly in India though they offer many advantages.
Hence, in the present study, an attempt is made to design and fabricate a computer-based system for the measurement of dielectric constant in liquids and also in binary liquid mixtures.

The work presented in the thesis is divided into four chapters, each chapter being sub-divided into several sections.

The first chapter is introductory. A brief introduction to dielectric constant is mentioned in section 1.1. A brief review of earlier experimental techniques for dielectric constant measurement in liquids is presented in section 1.2. The role of personal computers in instrumentation, in general, and with special reference to the present study is discussed in section 1.3. The purpose and scope of the present study is given in section 1.4.

The second chapter deals with the hardware details of the computer based system for measurement of dielectric constant in liquids. The principle of working of the system is presented in section 2.1. The design aspects of a dielectric cell are described in section 2.2. The section 2.3 gives the details of a function generator designed in the present study. The salient features of a personal computer are covered in section 2.4. The details of DIOT card are presented in section 2.5. The design of a regulated power supply used in the
present study is described in section 2.6. The section 2.7 describes the design and construction of a temperature control bath unit for constant temperature measurement.

The software features of the computer based measurement system for dielectric constant in liquids are presented in third chapter. The details of some of the important instructions in C language and the necessary flow charts are also presented in the same chapter.

Chapter 4 is devoted for discussion of the results. The procedure for calibration of the system is presented in section 4.1. It also deals with the presentation of results of dielectric constants of certain liquids to test the validity of the instrument. The results of the dielectric constant measurements in some binary liquid mixtures are presented in section 4.2. The non-ideal behaviour of liquid mixtures are characterized by excess dielectric constant $\varepsilon^E$ which indicates the nature of solute-solvent interactions. These aspects are studied in section 4.3. The computer based measurement system is quite successful in measuring the dielectric constants in liquids and binary liquid mixtures with an accuracy of ± 0.1%.
I convey my deep sense of gratitude to my research supervisor Prof. K. Malakondaiah, Department of Instrumentation & University Science Instrumentation Centre, Sri Krishnadevaraya University, Anantapur for his encouragement in my academic career. I convey my sincere thanks to him for his guidance and valuable suggestions which are of immense help in carrying out my research work.

I am grateful to Prof. S. V. Subrahmanyam (Rtd. Prof of Physics Department), Sri Krishnadevaraya University, Anantapur for his valuable suggestions.

I express my sincere thanks to Prof. K. Subbarangaiah, Department of physics, Sri Krishnadevaraya University, Anantapur for his valuable suggestions.

My thanks are due to Dr. B. Rama Murthy, Head : Department of Instrumentation and University Science Instrumentation Centre, Sri Krishnadevaraya University, Anantapur for his cooperation and help in carrying out my work.
I am very thankful to Sri S. Allahbaksh, Dr. C. Nagaraja, Dr. K. Nagabhushan Raju, and Dr. K. K. Azam Khan, Associate Professors, Department of Instrumentation and University Science Instrumentation Centre, Sri Krishnadevaraya University, Anantapur for their valuable suggestions.

I express my sincere thanks to Dr. P. Bhaskar, Associate Professor of Instrumentation, Gulbarga University Postgraduate Center, Raichur and Sri Nrasimha Murthy, Associate Professor, Head of the Department of Electronics, S. S. B. N. P.G. College, Anantapur for their help.

I am very grateful to my senior research scholar Sri. G. Satheesh Babu for his help in my research work. I am very grateful to my co-scholars M. Raja Rao, M. Ashok Kumar, N. Raghavendra Kumar, M. Lakshmi Prasad, K. Naghabushan Katte, S. Anand Paul, M. Anju Latha, and B. Vijay Kumar for their encouragement and support.

I am very thankful to my scholar friends K. Krishna Rao, M. Navven, A. B. V. Kiran Kumar, K. Naghabushan Reddy, M. Mallikarjuna Reddy and others from the Department of Chemistry, S. Navven, M. Sudhakar, N. Mohan
Reddy from Polymer Science & Technology, Sri Krishnadevaraya University, Anantapur for their cooperation.

I am very thankful to my scholar friends K. Suresh, Department of Maths, K. Rameswar Reddy, Department of Bio chemistry, P. S. Sarma, Department of Statistics, Chandra sekhar, Department of Electronics and Nani (Teacher), Sri Krishnadevaraya University, Anantapur.

I convey my thanks to the technical assistants Sri K.A. Madhusudhana Gowd, Sri G. Dhanunjaya, Sri P. Sudarsanam, Sri K. Saipasad Reddy and Sri G. Chandra Sekhara Rao, University Science Instrumentation Centre, Sri Krishnadevaraya University, Anantapur for their cooperation.

I extend my thanks to the staff of the workshop Sri S. Balaramaiah, Sri K. Venkateswara Rao, Sri M. Ganesh, Sri M. Obulesu, Sri V. Sahadevan and Jr. Assistant K.C. Obulesu, University Science Instrumentation Centre, Sri Krishnadevaraya University, Anantapur for their help.

I am highly indebted to my beloved mother Smt CH. Rama Laxmi, my father Sri CH. Krishna Murthy and my sister Kumari CH. Venkata Satya, younger brother Sri. CH. Siva Kumar for their keen interest and encouragement throughout my academic career.
My sincere thanks are due to M/S Mittal Enterprises, New Delhi for providing financial assistance to carry out this work. I am very grateful to the authorities of Sri Krishnadevaraya University, Anantapur for providing the necessary facilities.

CH.V. V. RAMANA