Cancer is a dreaded disease and one of the leading causes of death worldwide. The complete treatment of cancer is possible, only when it is detected at its early stage. The life span and also the quality of life are better when the disease is detected and treated early. The conventional diagnostic techniques are invasive, expensive and some of them are tedious.

In this context, fluorescence spectroscopy has emerged as a potential diagnostic tool, in particular, in the field of diagnostic oncology. Native fluorescence spectroscopy of tissues and body bio fluids with real time evaluation is considered as one of the most sensitive methods for monitoring minor changes in the structure and microenvironment of the native fluorophores and hence in the discrimination of tumors. Differences in the native fluorescence have been ascribed to various molecules such as tryptophan (Trp), tyrosine (Tyr), phenylalanine (Phe), indoxyl sulphate, reduced form of nicotinamide adenine dinucleotide (NADH), riboflavin, collagen, elastin, endogeneous porphyrins, pteridines and its derivatives.

Many applications of native fluorescence spectroscopy of biomolecules are reported on the characterization of cellular metabolic pathways and the discrimination of malignant from normal conditions of
tissues. However, only limited studies have been reported on the applications of native fluorescence spectroscopy of bio fluids in diagnostic oncology.

Among various biofluids, urine is considered to be one of the diagnostically important biological fluids as it has many metabolites where number of them are natural fluorophores. These metabolites are generally kept in balance in a healthy individual whereas in diseased subjects, changes do occur in the state of the tissue during the physiological processes or in connection with the onset of pathological conditions, resulting in the modification of the amount of fluorophores, their distribution and the physiochemical property of their environment. As fluorescence spectroscopy has many advantages and complementary techniques, the present study is aimed to study the potential of steady state and time resolved native fluorescence of urine in discriminating the malignant subjects with respect to normal subjects.

The first chapter deals with the brief introduction about cancer, various diagnostic modalities adopted for cancer diagnosis, native fluorescence of urine and its application in cancer diagnosis. The second chapter discusses the different experimental measurements, instruments and techniques adopted in the characterization of urine. In particular, it discusses about the different fluorescence spectroscopic techniques which were adapted in the thesis work. As it is always possible to improve the diagnostic capability of the techniques by an appropriate statistical method, Stepwise
linear discriminant analysis (LDA) and principal components analysis based LDA were used and only the better results of the two methods was discussed.

In third chapter, the results of Excitation Emission Matrices (EEMs) of human urine of normal subjects and cancer patients were discussed. Based on the results of EEMs, the native fluorescence emission characteristics of urine samples of cancer patients and normal subjects at 280 nm, 350 nm, 405 nm and 450 nm excitation wavelengths were measured and the spectral differences were discussed. Differences in the native fluorescence have been ascribed to various molecules, such as Indoxyl sulphate, nicotinamide adenine dinucleotide (NADH), pteridine and its derivatives, riboflavin and its metabolites and porphyrin present in urine. Based on the statistical analysis the excitation wavelength 405 nm was found to discriminate cancer patients from that of normal subjects efficiently followed by 450 nm.

In the fourth chapter, the fluorescence excitation spectroscopic technique was used to characterize the urine samples. The fluorescence excitation spectra of the urine samples were measured for emissions at 390nm, 450 nm and 520 nm. Similarly, the spectral signatures of different categories of urine were analyzed spectrally as well as statistically. Though, there appears some difference in the spectral signatures of the excitation spectrum, the statistical methods couldn’t discriminate the cancer patients from normal subjects effectively.
The fifth chapter deals with the characterization of urine of normal subjects and cancer patients using synchronized luminescence spectroscopy. The spectra were measured in the wavelength region 250 to 600 nm with a Stokes shift of 20 nm. Significant difference was observed from the spectral signature normal and cancer subjects of different stage and origin. Here also the discrimination of cervical cancer from normal subjects is good when compared to other classifications.

From the results of the steady state fluorescence measurements, it is observed that flavin plays an important role in the disease diagnosis. In this context, attempts were made to study the excited state kinetics of flavins present in urine samples of normal subjects and oral cancer patients at 460 nm excitation. In this context, sixth chapter discusses the excited state kinetics of flavins present in the urine of normal subjects and oral cancer patients. Not much difference was observed from the average lifetime of normal and cancer subjects and the statistical discrimination was not possible.

In the seventh chapter, the results arrived from steady state and time resolved fluorescence spectroscopy of urine of normal and cancer subjects are discussed and they are compared. From the study, it is concluded, the fluorescence emission spectra at 405 nm excitation followed by 450 nm excitation and synchronous luminescence spectra with a stokes shift of 20 nm discriminates the cancer subjects effectively from normal subjects. Pteridines and flavins are found to the suitable markers in the diagnosis of cancer. The scope of the future work also mentioned.