Chapter-2

Problem Formulation

In the last few decades in medical diagnosis, many researchers have contributed for labeled and label free techniques for detection of various parameters for the given analyte. A critical survey of the existing literature reveals that a good amount of work has been done in case of glucose detection by glucose oxidase principle; glucose in laboratory and blood sample; detection of DNA, protein, RBC and WBC counts of blood sample.

Thin film characterization has been reported by electrical, optical, structural, X-ray detector (XRD), ultraviolet-vis (UV-vis) spectroscopy, infrared (IR), scanning electron microscopy (SEM) and transmission electron microscopy (TEM) techniques. In recent days, different biosignal conditioning and processing by electronic systems have been developed.

Even though several methods have been adopted for detection of various parameters of blood sample, to the author’s knowledge no attempt has been made to synthesize and characterize the sensor film using conducting polymers and nanocomposites for glucose and leukocyte counts for the chosen analyte.

For cancer patients, the traditional clinical method of leukocyte count is tedious, time consuming and not economical. However in the present autoanalyzers, leukocyte count is made by differentiating size, sorting and counting of the cells. The volume of blood sample required for leukocyte counting varies between 1 to 5 ml as per prevailing techniques.

Hence, there is a definite need for sensor synthesis and characterization using conducting polymers and nanocomposites to detect glucose and leukocyte counts in real time blood sample.
The present work aims at the following:

- It is proposed to design, synthesize and characterize the sensor for biological real time applications using conducting polymers and gold nanocomposites.
- To investigate the electrical current-voltage (I-V) characteristics, by applying glucose oxidase (GOx) on the fabricated sensor by two-probe technique for different enzymes and laboratory glucose concentrations.
- To investigate the electrical I-V Characteristics by two probe technique by applying GOx on the fabricated sensor for various diluted blood concentrations.
- To investigate the electrical I-V Characteristics by two probe technique to determine leukocyte count for real time blood sample using different enzymes and its concentrations.
- To study the surface morphology of the fabricated sensor by atomic force microscopy (AFM) technique.
- To study the thickness of the synthesized sensor by optical profilometer technique.
- To design and develop a novel nano ampere and pico ampere signal conditioning electronic systems for processing biosensor signals.