The lead cobalt titanate (PCT) based nanoparticles will be synthesized via the sol-gel technique and further microwave heated at convenient temperatures. The diffraction study is used to reveal the formation of pure phases of PCT based materials. The structural parameters like average crystallite-size, X-ray density, specific surface area and strain need to be calculated in order to elucidate the systematic behaviour of lead titanate with distinct dopant elements. Further, the morphology is analyzed using scanning and transmission electron microscopy. The dielectric properties such as dielectric constant ($\varepsilon'$), dielectric loss ($\varepsilon''$) and ac-conductivity ($\sigma_{ac}$) are to be studied as a function of frequency. The ferroelectric property is discussed by P-E loop as a function of temperature.

**Scientific Importance and Prime Novelty of the Work:**

The PbTiO$_3$ nanoparticles can be utilized as building blocks for assembly of fascinating nano devices, as well as for exploring the fundamental nanoscale properties of PbTiO$_3$, which has not yet been studied. They can also be used to prepare ferroelectric/super paramagnetic core/shell nanoparticles (e.g., PbTiO$_3$/g-Fe$_2$O$_3$), which are potentially useful for tunable multifunctional (i.e., coexistence of ferroelectricity, piezoelectricity, and super paramagnetism) devices. These PbTiO$_3$ nanoparticles offers a good sinter ability to yield advanced ceramic materials. The present nanoparticles are expected to be good candidates for dielectric absorbers over the frequencies of less than or equal to 5 MHz. In addition, an attempt has to be made to investigate the ferroelectric nature of specimen in nano form as a function of temperature.

**Objectives of current work:**

- The lead cobalt titanate (PCT) based nanoparticles are going to be synthesized via the sol-gel technique and further microwave heated at convenient temperatures.
- The phases of PCT based nanoparticles will be revealed by X-Ray diffraction study.
The systematic behaviour of lead titanate upon distinct dopant elements are going to be elucidated by calculating structural parameters like average crystallite-size, X-ray density, specific surface area and strain.

Scanning and transmission electron microscopes are used to analyze the morphology of the specimen.

The dielectric properties such as dielectric constant ($\varepsilon'$), dielectric loss ($\varepsilon''$) and ac-conductivity ($\sigma_{ac}$) are to be investigated as a function of frequency.

The ferroelectric property will be studied as a function of temperature.