In these lectures, I am planning to develop the theory of Gelfand pairs $(G, K)$, with emphasis in the case that $G = K \rtimes N$, (semidirect product), where $N$ is a nilpotent Lie group and $K$ is a compact subgroup of automorphisms of $N$. Moreover we will consider generalized Gelfand pair, that is, when $K$ is not compact.

Then, we will study the spherical analysis associated: the set of spherical functions or distributions, and properties of the spherical transform.

Enlightening examples are given when $N$ is the Heisenberg group (or a group of Heisenberg type). We will see some of them in detail.