Titanium is one of the more abundant transition metals in space, and its dioxide is thought to be an important constituent of grains generated in the vicinity of oxygen-rich stars. Therefore, we have investigated the rotational spectrum of TiO$_2$ by laser-ablation molecular-beam Fourier transform microwave (LAMB-FTMW) spectroscopy between 7 and 42 GHz. Five isotopic species containing $^{46-50}$Ti were studied in natural isotopic composition and two, $^{48}$Ti$^{16}$O$^{16}$O and $^{48}$Ti$^{18}$O$_2$ were obtained through the use of $^{18}$O$_2$. Despite the comparatively large rotational constants and the absence of half of the rotational levels for all but the mixed $^{16}$O$^{18}$O isotopic species because of spin-statistics, up to 13 rotational transitions with energies up to almost 40 cm$^{-1}$ could be recorded, permitting rotational and quartic centrifugal distortion parameters to be determined along with hyperfine structure parameters for the species containing $^{47}$Ti or $^{49}$Ti. The derived molecular structure and the harmonic force field as well as the hyperfine structure parameters will be compared with those of related molecules. Preliminary results of a search toward several oxygen-rich late-type stars carried out with the IRAM 30 m telescope will also be presented.