Let $p$ be an odd prime and $\gamma(k, p^n)$ be the smallest positive integer $s$ such that every integer is a sum of $s$ $k$-th powers (mod $p^n$). Earlier we established $\gamma(k, p^n) \leq \lceil k/2 \rceil + 2$ and $\gamma(k, p^n) \ll \sqrt{k}$ provided that $k$ is not divisible by $(p - 1)/2$. Also if $t = (p - 1)/(p - 1, k)$, and $q$ is any positive integer, we showed that if $\phi(t) \geq q$ then $\gamma(k, p^n) \leq c(q)k^{1/q}$ for some constant $c(q)$. These results generalized results known for the case of prime moduli. Here we generalize these results to a number field setting. Let $F$ be a number field, $R$ its ring of integers and $P$ a prime ideal in $R$ that lies over a rational prime $p$ with degree of inertia $f$. Let $\gamma(k, P^n)$ be the smallest integer $s$ such that every algebraic integer in $F$ that can be expressed as a sum of $k$-th powers (mod $P^n$) is expressible as a sum of $s$ $k$-th powers (mod $P^n$). We prove for instance that when $t = (p^f - 1)/(p - 1, k)$ then $\gamma(k, P^n) \leq c(t)p^{nf/\phi(t)}$. (Received September 16, 2008)