Abstract: Magnetic nanoparticles have found broad applications in medicine, in particular as contrast agents for $T_1$- and $T_2$-weighted magnetic resonance imaging (MRI). The ability of a contrast agent to influence the proton relaxation rate in a tissue is described by its relaxivity. In the submitted bachelor thesis we characterise physical properties of samples of ε-$Fe_2O_3$ nanoparticles coated with amorphous silica ($SiO_2$), particularly with the aim to determine the dependences of their relaxivities on the magnetic field, temperature and thickness of silica coating. The distribution of the particle sizes was derived from the TEM pictures giving the median ~ 20 nm and the thickness of the silica coating ~4; 8; 13; 19 nm. The lattice parameters and presence of < 2% admixtures of α phase were ascertained by XRD analysis; hyperfine parameters obtained by Mössbauer spectroscopy indicate no change of magnetic properties of the particles by silica coating. The relative amount of ε-$Fe_2O_3$ and $SiO_2$ in the samples was specified from the magnetic measurements. Aqueous suspensions of different concentrations of coated nanoparticles were prepared, and their relaxivities $r_1$, $r_2$ were measured in different magnetic fields. Temperature dependence of relaxivities of a chosen sample was obtained in fields 0.47 T and 11.75 T. Field and temperature dependences are in agreement with theoretical models. The $r_2$ relaxivities of examined samples are generally lower than those of commercially produced superparamagnetic contrast agents γ-$Fe_2O_3$ and $Fe_3O_4$. Owing to their quadratic dependence on magnetisation in the motional averaging regime (MAR), the relaxivities may be enhanced by increasing the magnetisation with targeted substitutions of aluminium or gallium.