In this paper, we study the consensus problem for second-order multi-agent systems with heterogeneous unknown inertias and control gains under a general directed graph. Unlike the existing consensus algorithms for second-order multi-agent systems in which all agents are assumed to have common unit inertias or share common control gains, we allow the inertias and the control gains to be heterogeneous and time-varying for each agent. We propose fully distributed consensus algorithms over a general directed graph when there exist, respectively, absolute velocity damping and relative velocity damping. Novel integral-type Lyapunov functions are proposed to study the consensus convergence. Moreover, the adaptive σ-modification schemes for the gain adaptation are proposed, which renders smaller control gains and thus requires smaller amplitude on the control input without sacrificing consensus convergence. Furthermore, we show that one proposed algorithm also works for consensus of agents with intrinsic Lipschitz nonlinear dynamics. The control gains are varying and updated by distributed adaptive laws. As a result, the proposed algorithms require no global information and thus can be implemented in a fully distributed manner.