Abstract: The current study relates to designing a swarming computational paradigm to solve the influenza disease system (IDS). The nonlinear system's mathematical form depends upon four classes: susceptible individuals, infected people, recovered individuals and cross-immune people. The solutions of the IDS are provided by using the artificial neural networks (ANNs) together with the swarming computational paradigm-based particle swarm optimization (PSO) and interior-point scheme (IPA) that are the global and local search approaches. The ANNs-PSO-IPA has never been applied to solve the IDS. Instead a merit function in the sense of mean square error is constructed using the differential form of each class of the IDS and then optimized by the PSOIPA. The correctness and accuracy of the scheme are observed to perform the comparative analysis of the obtained IDS results with the Adams solutions (reference solutions). An absolute error in suitable measures shows the precision of the proposed ANNs procedures and the optimization efficiency of the PSOIPA. Furthermore, the reliability and competence of the proposed computing method are enhanced through the statistical performances.