A solar water heating system has been fabricated and tested to analyze the thermal performance of Parabolic Trough Solar Collector (PTSC) using twisted tape insert inside absorber tube with twisted ratio about TR=y/w=1.33. The performance of PTSC system was evaluated by using three main important indicators: water outlet temperature (Tout), useful energy and thermal efficiency (ηth) under the effect of mass flow rate (ṁ) ranges between 0.02 and 0.04 Kg/s with the corresponding of Reynolds number (Re) range (2000 to 4000). In a parallel, a fuzzy-logic model was proposed to predict the thermal efficiency (ηth) and Nusselt number (Nu) of PTSC depending on the experimental results. The fuzzy model consists of five input and two output parameters. The input parameters include: solar intensity (I), receiver temperature (Tr), water inlet temperature (Tin), water outlet temperature (Tout) and water mass flow ( ) while, the output include the thermal efficiency (ηth) and Nu. The final results indicate that, owing to the mixture of the swirling flow of the perforated twisted-tape insert, the perforated twist tape insert enhances the heat transfer characteristics and the thermal efficiency of the PTSC system. More specifically, the use of perforate twist tape inserts enhanced the thermal efficiency by 4% to 4.5% higher than smooth absorber tube. Also, the predicted values were found to be in close agreement with the experimental counterparts with accuracy of ~92 %. So, the suggested Fuzzy model system would have high validity and precision in forecasting the success of a PTSC system compared to that of the traditional model. Pace, versatility, and the use of expert knowledge for estimation relative to those of the traditional model are the advantages of this approach