

South East Asian J. of Mathematics and Mathematical Sciences
Vol. 22, No. 1 (2026), pp. 337-362

DOI: 10.56827/SEAJMMS.2026.2201.21

ISSN (Online): 2582-0850

ISSN (Print): 0972-7752

MATHEMATICAL MODEL FOR SCHIZOPHRENIA: PARAMETER ESTIMATION

Santoshi Panigrahi, Sunita Chand and Manoranjan Dash*

Department of Mathematics,
Institute of Technical Education and Research,
Siksha 'O' Anusandhan (Deemed to be University),
Khandagiri Square, Bhubaneswar - 751030, Odisha, INDIA
E-mail : santoshipanigrahi@soa.ac.in, sunitachand@soa.ac.in

*Institute of Business and Computer Studies,
Siksha 'O' Anusandhan (Deemed to be University),
Khandagiri Square, Bhubaneswar - 751030, Odisha, INDIA
E-mail : manoranjandash@soa.ac.in

(Received: Oct. 13, 2025 Accepted: Mar. 30, 2026 Published: Apr. 30, 2026)

Abstract: In this study, a fractional-order time-delay mathematical model for schizophrenia is investigated with a focus on parameter estimation. The model incorporates memory effects and delayed neural responses using Caputo fractional derivatives. A least squares approximation technique is employed to estimate unknown model parameters based on available data. Furthermore, the Fisher Information Matrix and profile likelihood methods are used to analyze parameter sensitivity and uncertainty. Numerical simulations are performed using MATLAB to validate the proposed approach. The results demonstrate that the fractional-order framework provides improved modeling accuracy and better representation of schizophrenia-related brain dynamics compared to classical integer-order models.

Keywords and Phrases: Parameter Estimation; Fractional differential equation, Caputo fractional derivative, Schizophrenia model.

2020 Mathematics Subject Classification: 93A30, 37N35, 34D20, 34E05,