



# PARTIAL DIFFERENTIAL EQUATIONS (PDE) FOR ENGINEERS: SOLUTION BY SEPARATION OF VARIABLES

**PROF. SIRSHENDU DE**

Department of Mathematics  
IIT KGP

**TYPE OF COURSE** : Rerun | Elective | UG/PG

**COURSE DURATION** : 4 Weeks (18 Jan' 21 - 12 Feb' 21)

**EXAM DATE** : 21 Mar 2021

**PRE-REQUISITES** : Basic knowledge of Mathematics

**INTENDED AUDIENCE** : Elective Course

UG/PG Course

BE/ME/MS/BSc/MSc/PhD

**INDUSTRIES APPLICABLE TO** : CSIR Institute & Laboratories.

All process industries and R & D organizations.

## **COURSE OUTLINE :**

Modeling is essential and imperative for understanding dynamics of a large scale process. One can undertake a large number of virtual experiments based on the model equations of a process to optimize the operating conditions and/or design the system efficiently. In most of the practical processes, model equations involve more than one parameters leading to partial differential equations (PDE). Various solutions techniques are adopted by the process engineers to solve the partial differential equations. Separation of variables is one of the most robust techniques used for analytical solution of PDEs. This technique provides first hand information of process dynamics rendering it amenable for optimization of system performance. This course aims to develop the solutions techniques and hence the skills of the students to solve PDEs for any engineering applications.

## **ABOUT INSTRUCTOR :**

Dr. Sirshendu De is a professor of the Department of Chemical Engineering at the Indian Institute of Technology Kharagpur. His research interests include membrane separations, transport processes and flow through micro-channels. He has over 200 international journal publications/peer reviewed articles, over 50 conference presentations (national and international). He is the holder of 15 patents (national and international), has authored 7 books and 4 of his developed technologies have been transferred to the industry. He is the winner of prestigious Shanti Swarup Bhatnagar Prize in Engineering Science and a fellow of Indian National Academy of Engineering and National Academy of Science India. Presently he is the INAE Chair Professor and Head of the Chemical Engineering Department, IIT Kharagpur.

## **COURSE PLAN :**

**Week 1:** Introduction, Definition & Type of PDE; Classification of various boundary condition & PDEs; Application of principle of linear superposition for PDE; Introduction of separations variables methods for solution of PDE.

**Week 2:** Solution of parabolic PDE using separations variables methods ; Solution of higher dimensional PDEs.

**Week 3:** Solution of Elliptic & Hyperbolic PDE using separations variables methods.

**Week 4:** PDE in cylindrical and Spherical coordinate.