Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2015
'B' Grade (CGPA 2.62)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: Mathematics

Name of the Course: Ph.D. Course work Paper No.3

(Syllabus to be implemented from June 2021)

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

Subject :- MATHEMATICS

Ph.D Course Work Syllabus Paper No.3
With effect from June 2021 – 2022

♦ **Objective of the Course :-**

(1) To design the syllabus with specific focus on key Learning Areas.

(2) To equip student with necessary fundamental concepts and knowledge base.

(3) To develop specific problem solving skills.

(4) To impart training on abstract concepts, analysis, deductive techniques.

(5) To prepare students for demonstrating the acquired knowledge.

(6) To encourage student to develop skills for developing innovative ideas.

(7) A student be able to apply their skills and knowledge that is translate information presented verbally into mathematical form select and use appropriate mathematical formulate or techniques in order to process the information and draw the relevant conclusion.

(8) A student should get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences.

NEW/REVISED SYLLABUS FOR M.Phil. / Pre Ph.D. (Mathematics) (Course Work)
(w.e.f. June 2021-2022 onwards)
Paper: III Title of Paper: Fractional Differential Equations

Teaching Scheme/Examination Scheme
Total Theory Lectures– **60** Total Credits -**06**
Total Marks -**150 (100 UA +50 CA)**

Unit I : Fractional derivatives: (6 Lectures)(0.5 Credit)(10 Marks)
Gamma function and its properties, Beta function, Contour integral representation. Fractional derivatives: Grunwald-Letnikov, Riemann-Liouville and Caputo's fractional derivative, Leibniz rule for fractional derivatives, Geometric and physical interpretation of fractional integration and fractional differentiation.

Unit II :Sequential fractional derivatives: (24 Lectures)(2.5 Credit)(40 Marks)
Left and right fractional derivatives. Properties of fractional derivatives. Laplace transforms of fractional derivatives. Fourier transforms and Mellin transforms of fractional derivatives.

Unit III : Linear Fractional Differential Equations: (24 Lectures)(2.5 Credit)(40 Marks)
Fractional differential equation of a general form. Existence and uniqueness theorem as a method of solution. Dependence of a solution on initial conditions. The Laplace transform method. Standard fractional differential equations. Sequential fractional differential equations.

Unit IV : Fractional Differential Equations: (6 Lectures)(0.5 Credit)(10 Marks)
Introduction, Linearly independent solutions, Solutions of the homogeneous and non-homogeneous fractional differential equations, Reduction of fractional partial differential equations to ordinary differential equations.

Reference Books:

1. Oldham K. B. & Spanier J., The Fractional Calculus: Theory and Applications of Differentiation and Integration to Arbitrary Order, Dover Publications Inc, 2006.
2. Miller K. S. & Ross. B., An Introduction to the Fractional Calculus and Fractional Differential Equations Hardcover, Wiley Blackwell, 1993.
3. Podlubny I., Fractional Differential Equations, Academic Press, 1998.