

# GANPAT UNIVERSITY

## FACULTY OF SCIENCE

### PH. D. Course work- Teaching and Examination Scheme

S.N	NAME OF SUBJECT	TEACHING SCHEME	EXAMINATION SCHEME		
		Credit	MARKS		
		Cr.	Int.	Ext.	Total
1	Research Methodology (Common)	4	60	40	100
2	Faculty Specific Topic ( Elective)	4	60	40	100
3	Research Seminar ( Elective)	2	60	40	100
		10	180	120	300

#### Note:

1. Ph.D Scholars shall require to opt one elective subject from the list decided by Faculty of Science for the Faculty specific topic. The selection of topic shall depend upon the specialization of the Ph.D scholar within the field of sciences.
2. Research Seminar shall be selected among the recent development of any subject area in consultation with guide allotted. Each scholar shall have to present research seminar on selected topic for the internal as well as external examination with documentary evidence for the efforts made on gathering required information in form of literature review.

**GANPAT UNIVERSITY**  
**FACULTY OF SCIENCE**  
**Ph. D Course work**  
**Research Methodology**  
**(Compulsory for all research scholars)**  
**Credit: 04**

**Course Contents**

- 1 Foundations of Research:** Meaning, Objectives, Motivation, Research process and steps of it, Types of research.
- 2 Research Design:** Concept and Importance in Research, Problem Definition, Variables, Literature survey and review, Concepts of Qualitative and Quantitative Research, Descriptive Research Design, Experimental Research Design.
- 3 Scientific writing:** Developing an outline, Research Proposal, Report writing, Thesis writing, Research paper, Book review, Reference writing, Scientific abbreviations, Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism, Referencing and various formats for reference for writing books and research papers.
- 4 Presentation skills:** Process for preparing and creating presentation, Use of visual aids, Use of power point, Nonverbal communication, Vocal skills.
- 5 Data Analysis:** Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association, Concept of measurement.
- 6 Tools and Techniques:** Methods to search required information effectively, Reference Management, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism, Area specific software.
- 7 Funding agencies:** Brief introduction of funding agencies (national and international), mandate of funding agencies and role of funding agencies for strengthening Research and Development facilities.

**Books Recommended:-**

1. 'Research Methodology- A Step-By-Step Guide for Beginners', **Ranjit Kumar**, (Pearson Education, Delhi) ISBN: 81-317-0496-3.
2. 'Research Methodology- Methods and Techniques', **Kothari, C.K.**, New Age International, New Delhi.
3. 'Research Methods', **Trochim, William M.K.**, Biztantra, Dreamtech Press, New Delhi, ISBN: 81-7722-372-0.
4. 'Design & Analysis of Experiments', **Montgomery, Douglas C.**, Wiley India.
5. "Applied Statistics & Probability for Engineers", **Montgomery, Douglas C.**, & **Runger, George C.**, Wiley, India.
6. Business Research Methods – **Donald Cooper & Pamela Schindler**, TMGH, 9th edition

**GANPAT UNIVERSITY**  
**FACULTY OF SCIENCE**  
**Ph. D Course work**  
**Faculty Specific Topic**  
**(Compulsory for Mathematics)**  
**Credit: 04**  
**Mathematics**

**Course Contents**

- 1 Ordinary Differential Equations (ODEs): Existence and Uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs. General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Riccati's equation.
- 2 Special Functions: Chebyshev polynomials, Beta and Gamma functions, Legendre's function of first kind, Legendre's function of second kind, Bessel's function, Hypergeometric function, Orthogonal set of functions and Sturm-Liouville problem.
- 3 Partial Differential Equations (PDEs): Linear PDE of order one, Non Linear PDE of order one, Homogeneous linear PDE with constant coefficients, Non-homogeneous linear PDE with constant coefficients, PDE reducible to equations with constant coefficients, PDE of order two with variable coefficients, Classification of PDE, Monge's method, Transport equation
- 4 Boundary value problems: Heat, Wave and Laplace equations – one dimensional, two dimensional and three dimensional, Method of separation of variables, Telegraph equation
- 5 Advanced Numerical Techniques: Iterative methods for linear systems: Classical iterative methods (Jacobi, Gauss-Seidel and successive over relaxation (SOR) methods), Finite difference method: Explicit and implicit schemes, Crank-Nicolson schemes, consistence, stability and convergence, Numerical solutions to elliptic, parabolic and hyperbolic partial differential equations. Dirichlet, Neumann and Mixed problems. Approximate method of solution: Galerkin method, properties of Galerkin approximations, PetrovGalerkin method, generalized Galerkin method. Finite Element Method (FEM): FEM for second order problems, one and two dimensional problems, finite elements (elements with a triangular mesh and a rectangular mesh and three dimensional finite elements), Numerical integration

**Books Recommended:-**

1. 'Advanced Differential Equations', **Dr.M.D.Raisinghania**, S.Chand, New Delhi.
2. 'Partial Differential Equation', **Lawrence C Evans**, American Mathematical Society
3. 'Advanced Ordinary Differential Equations', **Athanassios G. Kartsatos**, Hindawi Publishing Corporation
4. 'Numerical Solution of partial Differential Equations', **G.D.Smith**, Clarendon Press-Oxford Applied Mathematics and Computing Science series
5. 'Finite Element methods and their Applications', **Zhangxin Chen**, Springer
6. 'Advanced Engineering Mathematics', **Erwin Kreyszig**, John Wiley & Sons, Inc.
7. 'Numerical Methods in Engineering & Science', **B.S.Grewal**, Khanna Publishers.