FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART-A: INTRODUCTION				
Program : Bachelor in Science *(Honors/Honors with Research)*			**Semester - VII**	Session: 2024-2025
1	**Course Code**	**PHSE- 05**		
2	**Course Title**	**Mathematical Physics -II**		
3	**Course Type**	**Discipline Specific Elective**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	➢ Apply Fourier analysis of periodic functions in physical problems such as vibrating strings etc. ➢ Solve the beta, gamma and the error functions and their applications in doing integrations. ➢ Relate basic theory of errors, their analysis, and estimation with examples of simple experiments in Physics. ➢ Solve partial differential equations with the examples of important partial differential equations in Physics		
6	**Credit Value**	**4 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: CONTENT OF THE COURSE

Total No. of Teaching–learning Periods (01 Hr. per period) - 60 Periods (60 Hours)

Unit	Topics (Course contents)	No. of Period
I	Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers. **Partial Differential Equations**: Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry	15
II	**Fourier Series:** Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions. Application. Summing of Infinite Series	15
III	**Frobenius Method and Special Functions**: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite & Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Orthogonality. Simple recurrence relations. **Some Special Integrals:** Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions. Error Function (Probability Integral).	15
IV	**Complex Analysis**: Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula	15
Keywords	Calculus, Partial derivatives, Differential equations, Periodic function, Singular point, Beta and Gamma function, Complex number, Complex variables.	

Signature of Convener & Members (CBoS) :

10/6/24

PART–C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended–

1. Calculus of Several Variables and Partial Differential Equations by M.L. Krasnov, S.G. Miskin, and A.I. Gromova
2. Fourier Series and Boundary Value Problems by James Brown and Ruel Churchill
3. Differential Equations with Boundary Value Problems by Dennis G. Zill and Warren S. Wright
4. Complex Variables and Applications by James Ward Brown and Ruel V. Churchill

Reference Books Recommended–

1. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
2. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
3. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
4. An Introduction to Ordinary Differential Equations, E.A Coddington, 1961, PHI Learning
5. Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
6. Partial Differential Equations for Scientists and Engineers, S.J. Farlow, 1993, Dover Publications.
7. Mathematical methods for Scientists & Engineers, D.A. Mc Quarrie, 2003, Viva Books

Online Resources–

e-Resources / e-books and e-learning portals

1. NPTEL Online Courses: Dr Saurabh Basu (Complex analysis) https://nptel.ac.in/courses/115103036
2. NPTEL Online Course: V. Balkrishanan (Fourier Transform) :https://nptel.ac.in/courses/115106086
3. NOC: Mathematical Methods in Physics 1, IISER Bhopal, Prof. Auditya Sharma https://nptel.ac.in/courses/111106148
4. Vector Calculus, egyankosh: https://egyankosh.ac.in/handle/123456789/25388
5. e-PG pathshala: Mathematical Physics, https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+4mIqRALksfwQH9v8YSMrw==

PART -D:Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2):	**20 +20**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
	Assignment / Seminar -	**10**	
	Total Marks -	**30**	
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks** Section B: Descriptive answer type qts.,**1 out of 2** from each unit-**4x10=40 Marks**		

Name and Signature of Convener & Members of CBoS:

10/6/14