UNIVERSITY OF MADRAS

B.Sc. DEGREE PROGRAMME IN PHYSICS

SYLLABUS WITH EFFECT FROM 2023-2024

COURSE	FIFTH SEMESTER – ELECTIVE 1		
COURSE TITLE	**MATHEMATICAL PHYSICS**		
CREDITS	3	**Course Code**	**337E5B**
COURSE OBJECTIVES	To understand higher mathematical concepts which are applied to solve problems in Physics and similar situations		
UNITS	**COURSE DETAILS**		
UNIT-I	**MATRICES:** Types of matrices – Symmetric, Hermitian, Unitary and Orthogonal matrices– Characteristic equation of a matrix – Eigen values and Eigen vectors of a matrix – Cayley-Hamilton theorem – Inverse of matrix by Cayley-Hamilton theorem – diagonalization of 2x2 real symmetric matrices.		
UNIT-II	**VECTOR CALCULUS:** Vector differentiation – Directional derivatives –Definitions & Physical significance of Gradient, Divergence, Curl – Laplace operators– Vector Identities – Line, Surface and Volume integrals – Statement, proof and simple problems for Gauss's divergence theorem, Stoke's theorem, Green's theorem.		
UNIT-III	**ORTHOGONAL CURVILINEAR COORDINATES:** Tangent basis vectors – scale factors – unit vectors in cylindrical and spherical coordinate systems –gradient of a scalar –divergence and curl of a vector – Laplacian in these coordinate systems.		
UNIT-IV	**FOURIER SERIES:** periodic functions – Dirichlet's conditions – general Fourier series – even and odd functions and their Fourier expansions – Fourier cosine and sine – half range series – change of length of interval. Fourier analysis of square wave, saw-tooth wave, half wave/full wave rectifier wave forms.		
UNIT-V	**FOURIER TRANSFORMS**: Fourier Integral theorem(Statement only)–Fourier, Fourier sine and Fourier cosine transforms,– Fourier transform of single pulse – trigonometric, exponential and Gaussian functions – inverse Fourier transform – convolution theorem.		

TEXT BOOKS	1. Mathematical Physics, Sathya Prakash, Sultan Chand & Sons, New Delhi, Fifth Revised and Enlarged Edition, 2006, (Reprint 2007 2.Mathematical Physics – P. K. Chattopadhyay, New Age International Publishers. 3.Mathematical Physics – B. D. Gupta. 4.Mathematical Physics – H. K. Das, S. Chand & Co, New Delhi
REFERENCE BOOKS	1. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill. 2. Engineering Mathematics III- B, M. K. Venkataraman, 3. Applied Mathematics for Scientists and Engineers, Bruce R. Kusse & Erik A. Westwig, 2nd Ed, WILEY-VCH Verlag, 2006. 4. Vector space & Matrices – J. C. Jain, Narosa Publishing House Pvt. Ltd.

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total
25	**75**	**100**

COURSE OUTCOMES

At the end of the course, the student will be able to:

COURSE OUTCOMES	**CO1**	To use advanced mathematical methods and theories on various mathematical and physics problems
	CO2	To develop the skill of problem-solving ability.
	CO3	Use Matrices to solve simultaneous equations
	CO4	To understand electromagnetic theory with Vector Calculus
	CO5	Apply Fourier series to simple circuits.

MAPPING WITH PROGRAM OUT COMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3 point scale of STRONG(**S**), MEDIUM (**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	S	S	M	S	S
CO2	S	S	M	S	M	M	S	M	M	M
CO3	M	M	S	M	S	M	M	S	S	S
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	M	M	S	M	M	S