

**ST. JOSEPH'S COLLEGE OF ARTS AND SCIENCE  
(AUTONOMOUS)  
CUDDALORE -1**



**P.G. AND RESEARCH DEPARTMENT OF PHYSICS**

**BOARD OF STUDIES –II**

**c. M.Phil., PHYSICS**

**SYLLABUS  
2021-2022**

<b>PG AND RESEARCH DEPARTMENT OF PHYSICS</b>									
<b>CURRICULUM TEMPLATE</b>									
<b>c. M.Phil., Physics</b>									
<b>SEMESTER – I</b>									
<b>S. No</b>	<b>Part</b>		<b>Hours/Week</b>	<b>Credit</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Maximum Marks</b>		
							<b>CIA</b>	<b>ESE</b>	<b>TOTAL</b>
1	III	Core Theory-1	7	5	MPH101	Research Methodology	25	75	100
2	III	Core Theory-2	7	5	MPH102	Advanced Physics-I	25	75	100
<b>Semester Total</b>			<b>14</b>	<b>10</b>			<b>50</b>	<b>150</b>	<b>200</b>

<b>M.Phil. PH</b>	<b>RESEARCH METHODOLOGY</b>	<b>MPH101</b>
<b>SEMESTER –I</b>		<b>HRS/WK-7</b>
<b>CORE - I</b>		<b>CREDIT-5</b>

**OBJECTIVES:**

To know about the objectives of research methodology and learn about research writing, computational and numerical methods and gain knowledge to figure out the errors in research problems.

**COURSE OUTCOMES (CO):**

- CO1:** To know about the various types of research methodology
- CO2:** Understand various types of thesis writing
- CO3:** To know the errors and approximations in research problem
- CO4:** To understand the various numerical methods
- CO5:** Understand the basic computer based data analysis

**Mapping of course outcomes with the program specific outcomes**

SEMESTER - IV	COURSE CODE: MPH101					COURSE TITLE: RESEARCH METHODOLOGY						Hours:	Credit:
	Programme Outcomes POs					Programme Specific Outcomes PSOs						Mean Score of CO's	7
Course Outcomes COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6		
CO1	3.2	3.8	4.1	3.5	3	2.8	3.5	3.1	4	3	3.2	3.38	
CO2	3.5	3.2	3.2	3	3.5	3.6	4	3.6	3	2.6	3.8	3.36	
CO3	3.5	4.1	3.2	2.6	3	3.2	3	3.5	3.5	3.5	3	3.28	
CO4	3.2	3.8	3	4	3	4	3.5	2.8	3.5	3	3.6	3.4	
CO5	4	3.5	3.5	3.2	3.5	2.5	3.5	3	4	3	3.5	3.38	
Mean Overall Score											3..36		

**Result: The Score for this course is 3.36 (High)**

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
<b>Value Scaling</b>					
Mean Score of COs= $\frac{\text{Total Values}}{\text{Total No. of POs \& PSOs}}$			Mean Overall Score of COs= $\frac{\text{Total Mean Scores}}{\text{Total No. of COs}}$		

This course is having **High** association with Programme Outcome and Programme Specific Outcome.

### **UNIT - I**

**Research Methodology:** Meaning of research - Objectives of research - Motivation of research - Types, Approaches and Significance - Method Versus Methodology - Research in Scientific methods - Research Process - Criteria for Good Research - Problem Encountered by Research in India. Research Problem - Selecting the problem - Necessity of defining the problem - Techniques involved in Defining the problem - Research Design - Needs and Features of Good Design - Different Research Design - Basic Principles of Experimental Design - Funding Agencies.

### **UNIT - II**

**Thesis Writing:** Meaning of Research Report-Logical Format for Writing Thesis and Paper-Essential of Scientific Report: Abstracts, Introduction, Review of Literature, Material and Method and Discussion-Write Up steps in drafting report- effective illustrations: Tables and figures- Reference styles: Harvard and Vancouver systems-synopsis writing-overhead projector presentation-power point presentation.

### **UNIT - III**

**Errors And Approximations:** Statistical analysis of data-Mean, median, mode and Standard Deviation - Correlation - Comparison of sets of data- Chi Squared analysis for data - Characteristics of probability Distribution - Binomial, Poisson and Normal Distribution-Principle of Least Square Fitting - Curve fitting - theory of Errors - Types and Sources of Errors - Errors and residue.

### **UNIT - IV**

**Numerical Methods:** Newton's forward and backward difference interpolation formula-Numerical integration by Trapezoidal & Simpson's one third rule-Taylor series .Differential equation method

### **UNIT - V**

**Computer Based Data Analysis:** Origin 8-Data analysis and Graphing workspace-Workbook-Worksheet& Worksheets column-Importing and Exporting data-Graphing: Customizing and formatting the graph-Fitting analysis-Introduction to MATLAB. Introduction to Gaussian method-Quantum analysis-Ab initio approximation method

### **REFERENCE BOOKS:**

1. Research Methodology, Methods And Techniques- C. R. Korthari-WishwaPrakasam Publications, II Edition.2004
2. A Handbook of Methodology of Research – Rajammal P.A. Devadass-Vidyalaya Press.2011
3. Statistical Methods- S. P. Gupta 2007

4. Numerical methods –B.D.Guptha 2013

<b>M.Phil. PH</b>	<b>ADVANCED PHYSICS-I</b>	<b>MPH102</b>
<b>SEMESTER –I</b>		<b>HRS/WK-7</b>
<b>CORE - II</b>		<b>CREDIT-5</b>

**OBJECTIVES:**

To understand the types and phases of solids particularly about nuclear and molecular mechanics

**COURSE OUTCOMES:**

- CO1:** To know about Schrodinger and Klein Gordon field equation
- CO2:** Understand various types of nuclear models and quark
- CO3:** To know types of bonds in solids
- CO4:** Understand the dielectric studies in different phase
- CO5:** Understand the non linear and molecular mechanics

**Mapping of course outcomes with the program specific outcomes**

SEMESTER - IV	COURSE CODE: MPH102					COURSE TITLE: ADVANCED PHYSICS-I						Hours: 7	Credit: 5
Course Outcomes COs	Programme Outcomes POs					Programme Specific Outcomes PSOs						Mean Score of CO's	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6		
CO1	3.5	2.5	4.1	3.5	3.5	2.5	3	3.5	4.2	3.2	3.2	3.33	
CO2	3.6	3.2	3.6	3	3.5	2.8	4.1	3.6	3.7	2.3	3.5	3.35	
CO3	3.5	4.3	3.5	2.8	3	3.6	3.5	3.5	3.7	4.2	3.3	3.53	
CO4	3.2	3.6	3	4	3	3.5	3.4	2.8	3.4	3.5	3.6	3.36	
CO5	4	3.5	3.5	3.2	3.6	2.5	3.5	3.2	4	3.2	3.5	3.42	
Mean Overall Score												3.40	

**Result: The Score for this course is 3.40 (High)**

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
<b>Value Scaling</b>					
Mean Score of COs= $\frac{\text{Total Values}}{\text{Total No. of POs \& PSOs}}$			Mean Overall Score of COs= $\frac{\text{Total Mean Scores}}{\text{Total No. of COs}}$		

This course is having **High** association with Programme Outcome and Programme Specific Outcome

### **UNIT - I**

**Quantum Mechanics:** Second Quantization of Schrodinger and Klein –Gordon fields-creation and annihilation operators- Commutation relations- second Quantization of Dirac field- covariant and anti-commutation relation for Dirac field.

### **UNIT – II**

**Nuclear and Particle Physics:** Compound nucleus and statistical theory- experimental evidence- statistical assumption – average cross section- angular distribution- transmission coefficients- level density- decay of the statically compound nucleus- emission of charged particles. Symmetries and conservation laws – Gell Mann Nishijima formula – CPT invariance – Quark model

### **UNIT – III**

**Solid State Physics:** Types of bonds in crystals-Ionic, Valence, Metallic, Vander Waals and hydrogen bonding-Band structure theory – Band structure for some semiconductors – Semiconductor transport theory – Basis of continuity equation – Kronig penny model - Theory of generation and recombination – theory of PN junction – solar cells – Ionic conductivity – Normal and super ionic conductors – Application of super ionic solids - Fuel cells, Electro chromic display.

### **UNIT – IV**

**Dielectric Studies:** Basic concepts of dielectrics: static fields –Time dependent fields – Static dielectric constant: Dipolar interaction – dipolar molecules in gases and dilute solutions – Onsager equation – Debye equations – Dielectric relaxation and loss – Distribution of relaxation time – Complex plane diagrams – Cole- Cole, Cole- Davidson plots.

### **UNIT – V**

**Non-Linear And Molecular Mechanics:** Basis of nonlinearity – Linear and nonlinear oscillators – Autonomous and non-autonomous system – Dynamical systems. The energy calculations – Energy minimization – Force field paramertization – Conformation analysis – Solvation – Monte Carlo methods – Molecular dynamics – Free energy calculation.

### **REFERENCE BOOKS:**

1. Advanced Quantum Mechanics – Sathyaprakash 2004
2. Elementary Particles – D. Griffiths.2010
3. Solid state physics by Sexena& Gupta Sexena
4. Lasers &Non linear optics, B.B.Laud-New age International pvt. Ltd, 2<sup>nd</sup> ed. 2009

**Question Paper Pattern (as per your board of studies recommendations)**

**THEORY EXAMINATION**

**Internal Examination (25 marks)**

Two Internal Examinations	15 marks
Assignment / Seminar	10 marks
<b>Total</b>	<b>25 marks</b>

**External Examination (75 marks)**

**Question Pattern**

**M. Phil. Physics**

**Time: 3 Hours**

**Max. Marks: 75**

**Section A (5×15=75 marks)**

**(Answer Any 5 out of 8)**