

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



**PG & RESEARCH DEPARTMENT OF PHYSICS**

**M.Phil (Physics)**

**SYLLABUS 2019-2020**

**P.G. and Research Department of Physics**  
**M.Phil Physics**  
**Curriculum Template**

Semester & Course	Course number/ Code	Credits earned	Marks secured (Max:100)
<b>First Semester</b>			
Core	MPH101	5	70
Core	MPH102	5	60
Elective		5	75
Grade point total			
Weight average total		15	68.33
<b>Second Semester</b>			
Dissertation & Viva voce	JPH201	21	64
Grade point total			
Weight average total		21	64
Cumulative grade point average 36			65.81
Overall weighted percentage marks			

**Question paper pattern (Semester)**

Internal – 25 Marks

External – 75 Marks

**Section A (5×15=75 marks)**

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

<b>YEAR- I SEM- I</b>	<b>Course Code MPH101</b>	<b>Course Title: RESEARCH METHODOLOGY</b>						<b>HRS/WK 7</b>	<b>CREDIT 5</b>			
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											
<b>Mapping of course outcomes with the program specific outcomes</b>												
<b>Course Outcomes Cos</b>	<b>Programme Outcomes POs</b>					<b>Programme Specific Outcomes PSOs</b>						<b>Mean Score of CO's</b>
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	1.4	3.3	1.1	3.1	2.3	4.2	4.2	4.1	3.8	4.7	2.3	3.13
CO2	1.2	3.5	1.3	3.2	2.6	4.4	4.3	4.1	3.9	4.2	2.1	3.16
CO3	1.6	3.8	1.4	3.2	2.6	4.8	4.6	3.9	3.8	4.0	2.4	3.28
CO4	1.8	3.8	1.4	3.2	2.4	4.5	4.1	3.9	4.2	3.5	2.1	3.17
CO5	1.2	3.6	1.1	3.3	2.9	4.1	4.4	4.0	4.1	4.3	2.1	3.19
Mean Overall Score											3.39	
<b>Result: The Score for this course is High</b>												
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			
Value Scaling												
Mean Score of COs= $\frac{\text{Total Values}}{\text{Total No. of POs \& PSOs}}$						Mean Overall Score of COs= $\frac{\text{Total Mean Scores}}{\text{Total No. of COs}}$						

## **PART-1 CORE COURSE-1**

### **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, 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-Wishwa Prakasam Publications, II Edition.2004
2. A Handbook of Methodology of Research – Rajammal P.A. Devadass-Vidyalaya Press.2011
3. Thesis and assignment writing- Anderson- Wiley Eastern Ltd.1998
4. Statistical Methods- S. P. Gupta 2007
5. Numerical methods-P.K andasamy,K.Thilagavathi&K.Gunavathi 1985
6. Numerical methods –B.D.Guptha 2013
7. Numerical methods-Rajaram. 2013
8. Alan Hinchliffe,Molecular Modelling for Beginners, Second Edition, the university of mancheste,2008,johnwiley&sons Ltd.
9. Andrew R.leach Molecular Modelling, principle Applications. Pearson Education Limited 1996, 2001.

YEAR- I SEM- I	Course Code MPH102	Course Title: ADVANCED PHYSICS-I	HRS/WK 7	CREDIT 5								
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											
<b>Mapping of course outcomes with the program specific outcomes</b>												
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	3.5	3	3.2	3.5	4	3	3	3.5	3.5	4	3.38
CO2	4	4	3.5	4	4	4	2.5	3.5	4	3.5	4	3.73
CO3	4	3.5	4	3.5	3	3.5	4	4	4	3	3.5	3.64
CO4	3.5	3.5	4	3.5	3.5	3.5	4	3.5	3.5	3.5	3.5	3.59
CO5	4	4	3.5	3.5	4	4	3.5	4	4	3.5	3	3.73
Mean Overall Score											3.61	
<b>Result: The Score for this course is High</b>												
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			
Value Scaling												
Mean Score of COs= $\frac{\text{Total Values}}{\text{Total No. of POs \& PSOs}}$						Mean Overall Score of COs= $\frac{\text{Total Mean Scores}}{\text{Total No. of COs}}$						

### **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 parameterization – Conformation analysis – Solvation – Monte Carlo methods – Molecular dynamics – Free energy calculation.

**Reference books:**

1. Advanced Quantum Mechanics – Sathyaprakash 2004
2. Physics of the Nucleus – M.A. Preston – Addison – Wesley 1962
3. Elementary Particles – D. Griffiths.2010
4. Nonlinear dynamics – M. Lakshmanan and S. Rajesekar – Springer International 2003
5. Super ionic solids – S. Chandra – North Holland Publishing Company Ltd.1981
6. Theory of Dielectrics – H. Frohlich – Oxford University Press
7. Solid state physics by Sexena & Gupta Sexena
8. Lasers & Non linear optics, B.B.Laud-New age International pvt. Ltd, 2<sup>nd</sup> ed. 2009