FATIMA COLLEGE (AUTONOMOUS)

Re-Accredited with "A" Grade by NAAC (3rd Cycle)
Maryland, Madurai- 625 018, Tamil Nadu, India

NAME OF THE DEPARTMENT: RESEARCH CENTRE OF PHYSICS

NAME OF THE PROGRAMME : M.Sc

PROGRAMME CODE : PAPH

ACADEMIC YEAR : 2021-2022

VISION OF THE DEPARTMENT

Educating and empowering the youth and make them excel in all fields of Physics.

MISSION OF THE DEPARTMENT

- To ignite the young minds and impart quality education in basic Physics
- To promote enthusiasm in the study of physics through innovative and dedicated teaching methodologies
- To discover the budding talents in theoretical and experimental physics and ensure their global competency
- To provide a stimulating environment and strengthen basic and application oriented research aptitude among the students.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

A graduate of M.Sc. Physics programme after two years will be

PEO 1	Our graduates will be academic, digital and information literates, creative, inquisitive, innovative and committed researchers who would be desirous for the "more" in all aspects
PEO 2	They will be efficient individual and team performers who would deliver excellent professional service exhibiting progress, flexibility, transparency, accountability and in taking up initiatives in their professional work
PEO 3	The graduates will be effective managers of all sorts of real – life and professional circumstances, making ethical decisions, pursuing excellence within the time framework and demonstrating apt leadership skills
PEO 4	They will engage locally and globally evincing social and environmental stewardship demonstrating civic responsibilities and employing right skills at the right moment.

GRADUATE ATTRIBUTES (GA)

Fatima College empowers her women graduates holistically. A Fatimite achieves all-round empowerment by acquiring Social, Professional and Ethical competencies. A graduate would sustain and nurture the following attributes:

I. SOCIAL COMPETENCE	
GA 1	Deep disciplinary expertise with a wide range of academic and digital literacy
GA 2	Hone creativity, passion for innovation and aspire excellence
GA 3	Enthusiasm towards emancipation and empowerment of humanity
GA 4	Potentials of being independent
GA 5	Intellectual competence and inquisitiveness with problem solving abilities befitting the field of research
GA 6	Effectiveness in different forms of communications to be employed in personal and professional environments through varied platforms
GA 7	Communicative competence with civic, professional and cyber dignity and decorum
GA 8	Integrity respecting the diversity and pluralism in societies, cultures and religions
GA 9	All – inclusive skill sets to interpret, analyse and solve social and environmental issues in diverse environments
GA 10	Self awareness that would enable them to recognise their uniqueness through continuous self-assessment in order to face and make changes building on their strengths and improving their weaknesses
GA 11	Finesse to co-operate exhibiting team-spirit while

	working in groups to achieve goals
GA 12	Dexterity in self-management to control their selves in attaining the kind of life that they dream for
GA 13	Resilience to rise up instantly from their intimidating setbacks
GA 14	Virtuosity to use their personal and intellectual autonomy in being life-long learners
GA 15	Digital learning and research attributes
GA 16	Cyber security competence reflecting compassion, care and concern towards the marginalised
GA 17	Rectitude to use digital technology reflecting civic and social responsibilities in local, national and global scenario
II. PROFESSIONAL COMPETENCE	
GA 18	Optimism, flexibility and diligence that would make them professionally competent
GA 19	Prowess to be successful entrepreuners and become employees of trans-national societies
GA 20	Excellence in Local and Global Job Markets
GA 21	Effectiveness in Time Management
GA 22	Efficiency in taking up Initiatives
GA 23	Eagerness to deliver excellent service
GA 24	Managerial Skills to Identify, Commend and tap Potentials
III. ETHICAL COMPETENCE	
GA 25	Integrity and be disciplined in bringing stability leading a systematic life promoting good human

	behaviour to build better society
GA 26	Honesty in words and deeds
GA 27	Transparency revealing one's own character as well as self-esteem to lead a genuine and authentic life
GA 28	Social and Environmental Stewardship
GA 29	Readiness to make ethical decisions consistently from the galore of conflicting choices paying heed to their conscience
GA 30	Right life skills at the right moment

PROGRAMME OUTCOMES (PO)

The learners will be able to

PO 1	Apply acquired scientific knowledge to solve major and complex issues in the society/industry.
PO 2	Attain research skills to solve complex cultural, societal and environmental issues.
PO 3	Employ latest and updated tools and technologies to solve complex issues.
PO 4	Demonstrate Professional Ethics that foster Community, Nation and Environment Building Initiatives.

PROGRAMME SPECIFIC OUTCOMES (PSO)

On completion of **M.Sc. Physics** programme, the graduates would be able to

PSO 1	Acquire thorough knowledge of the basic concepts of the frontier areas of Physics comprising Mathematical Physics, Electromagnetic theory, Classical Mechanics, Quantum Mechanics, Condensed Matter Physics, Nuclear Physics, Numerical Methods, Communication systems, Molecular Spectroscopy, Material Science and Advanced Quantum Mechanics.
PSO 2	Understand and solve the physics problems in everyday life using the acquired basic knowledge.
PSO 3	Develop skills to perform experiments based on the theoretical understanding
PSO 4	Apply the knowledge acquired to analyse and design models in the versatile realm of physics.
PSO 5	Equip with the essential foundations for higher education and research in physics.

FATIMA COLLEGE (AUTONOMOUS), MADURAI-18

DEPARTMENT OF PHYSICS

For those who joined in June 2019 onwards

MAJOR CORE – 70 CREDITS

PROGRAMME CODE: PAPH

COURSE CODE	COURSE TITLE	HRS / WK	CREDIT	CIA Mks	ESE Mks	TOT. MKs
SEMESTER – I						
19PG1P1	Introduction to Mathematical Physics	5	3	40	60	100
19PG1P2	Applied Electronics	5	3	40	60	100
19PG1P3	Classical Mechanics	5	3	40	60	100
21PG1P4	Applied Optics	4	3	40	60	100
19PG1P5	Practicals-I Non Electronics	4	2	40	60	100
19PG1P6	Practicals-II Electronics	4	2	40	60	100
Total		**27**	**16**			
SEMESTER – II						
19PG2P7	Advanced Mathematical Physics	5	3	40	60	100
19PG2P8	Quantum Mechanics	5	3	40	60	100
19PG2P9	Electromagnetic Theory	5	3	40	60	100
21PG2P10	Instrumentation and Microcontroller	4	3	40	60	100
19PG2P11	Practicals-III Non Electronics	4	2	40	60	100
19PG2P12	Practicals-IV Electronics	4	2	40	60	100
Total		**27**	**16**			

COURSE CODE	COURSE TITLE	HRS / WK	CREDIT	CIA Mks	ESE Mks	TOT. MKs
SEMESTER – III						
19PG3P13	Condensed Matter Physics	6	5	40	50	100
19PG3P14	Statistical Mechanics	6	5	40	60	100
19PG3P15	Nuclear and Particle Physics	6	5	40	60	100
19PG3P16	Practicals– V General Physics Lab	4	2	40	60	100
19PG4P17	Practicals – V1 Advanced Electronics	4	2	40	60	100
Total		**26**	**19**			
SEMESTER – IV						
19PG4P18	Advanced Condensed Matter Physics	6	5	40	60	100
19PG4P19	Molecular Spectroscopy	6	5	40	60	100
19PG4P20	Advanced Quantum Mechanics	6	5	40	60	100
19PG4P21	Practicals –VII Advanced General Physics Lab	4	2	40	60	100
19PG4P22	Practicals –VIII PROGRAMMING IN C++	4	2	40	60	100
Total		**26**	**19**			
	Total	**106**	**70**			

MAJOR ELECTIVE / EXTRA DEPARTMENTAL COURSE / INTERNSHIP/ PROJECT -20 CREDITS

S. No	SEM.	COURSE CODE	COURSE TITLE	HRS	CREDITS	CIA Mks	ESE Mks	TOT. Mks
1.	**I**	19P1EDC	Modern Photography	3	3	40	60	100

2.	**II**	19P2EDC	Modern Photography	3	3	40	60	100
3.	**III**	19PG3PE1A/ 19PG3PE1B	Communication system/ Numerical methods and Programming in C++	4	4	40	60	100
4.		19PG3PSI	Summer Internship	-	3	40	60	100
5.	**IV**	19PG4PE2A/ 19PG4PE2B	Material Science / Astro Physics	4	4	40	60	100
6.		19PG4PPR	Project		3	40	60	100
			TOTAL	**14**	**20**			

OFF-CLASS PROGRAMME

ADD-ON COURSES

Course Code	Courses	Hrs.	Credits	Semester in which the course is offered	CIA Mks	ESE Mks	Total Marks
19PAD 2SS	**SOFT SKILLS**	40	4	I	40	60	100
19PAD 2CA	**COMPUTER APPLICATIONS** LATEX (Dept. Specific Course)	40	4	II	40	60	100
	MOOC COURSES (Department Specific Courses) * Students can opt other than the listed course from UGC-SWAYAM /UGC	-	Minimum 2 Credits	-	-	-	

	/CEC						
19PAD 4CV	**COMPREHENSIVE VIVA** (Question bank to be prepared for all the papers by the respective course teachers)	-	2	IV	-	-	100
19PAD 4RC	**READING CULTURE**	15/ Semester	1	I-IV	-	-	-
	TOTAL		13 +				

EXTRA CREDIT COURSE

Course Code	Courses	Hrs.	Credits	Semester in which the course is offered	CIA Mks	ESE Mks	Total Marks
19PGSLP1	**SELF LEARNING COURSE for ADVANCE LEARNERS (Offered for II PG)** Instrumentation & Experimental Methods	-	3	III & IV	40	60	100
21PG2PSL1	**NANOTECHNOLOGY FOR ALL**	-	3	II	40	60	100

- **Lab Courses:**
  - A range of 10-15 experiments per semester

- **Summer Internship:**

- Duration-1 month (2nd Week of May to 2nd week of June-before college reopens)

- **Project:**
  - Off class
  - Evaluation components-Report writing + Viva Voce (Internal marks-50) + External marks 50

- **EDC:**

  Syllabus should be offered for two different batches of students from other than the parent department in Sem-I & Sem-II

I M.Sc.PHYSICS

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEE	CREDITS

				K	
PAPH	**19PG1P1**	**INTRODUCTION TO MATHEMATICAL PHYSICS**	**Theory**	**5**	**3**

COURSE DESCRIPTION

This course emphasise the basic concepts and applications of Mathematical Physics which involves vectors, matrices, integral transforms and special functions

COURSE OBJECTIVES

This course provides the mathematical foundation in vectors, matrices, special functions and Fourier and Laplace transforms required for the description of the physical phenomena.

UNIT –I VECTORS **(15 HRS)**

Gauss's Divergence theorem –Deductions from Gauss's Divergence theorem- Stokes's theorem- orthogonal curvilinear coordinates- differential operators- spherical polar coordinates

UNIT –II MATRICES **(15 HRS)**

Introduction-Review of algebraic operators on matrices-Sub matrices- Partitioning of matrices – Special types of Matrices – Vectors as Matrices and vector spaces- Linear transformations-The Eigen value problems

UNIT –III INTEGRAL TRANSFORMS **(15 HRS)**

Introduction - Fourier transform- Few properties of Fourier transform (Shifting property, Convolution property, Parseval's theorem)- Fourier transform of derivatives -Development of the inverse Fourier transform – Laplace transforms- properties of Laplace transforms- Laplace transform of derivatives- Inverse Laplace transform – properties of Inverse Laplace transform

UNIT –IV SPECIALFUNCTIONS I: (15 HRS)

Definitions – The Beta function- Gamma function -The relation between the Beta function and the Gamma function.

Legendre's differential equation and Legendre functions, generating function –Rodrigue formula-orthogonal properties-recurrence formula

UNIT –V SPECIAL FUNCTIONS II: (15 HRS)

Bessel differential equations-Bessel functions of the first kind – recurrence formula- generating function – Hermite polynomials – generating function-Rodrigue formula-orthogonal properties-recurrence formula

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Solving Problems on Fourier transforms and special functions

REFERENCES:

Mathematical Physics with classical mechanics by Satya Prakash – Sultan Chand and Sons, Fourth Revised and enlarged edition 2002

Unit I - Sec 1.7- 1.9,1.15

Unit II - Sec 2.1 –2.5, 2.9-2.19, 2.23, 2.26-2.34

Unit III- Sec 9.1-9.4, 9.9-9.11, 9.15, 9.17

Unit IV -Sec 4.1-4.7,6.7-6.11

Unit V - Sec 6.17,6.21,6.22,6.29-6.33

BOOKS FOR REFERENCE:

1. The Mathematics of physics and chemistry by Margenau& Murphy

2. Fourier Transforms in Physics- D.C. ChampneyWiley Eastern Ltd. July 1988.

3. Matrices and Tensors in Physics – A.W. Joshi-2nd edition

4. Applied Mathematics for engineers and Physicists by Louis. A. Pipes and Lawrence R. Harvill IIIedn. McGraw – Hill International

5. Essential Mathematical methods for Physicists by Hans. J. Weber and George. B.Arfken- Academic Press

COURSE CONTENTS & LECTURE SCHEDULE

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 VECTORS				
1.1	Gauss's Divergence theorem	2	Chalk & Talk	Black Board
1.2	Deductions from Gauss's Divergence theorem	2	Chalk & Talk	Black Board
1.3	Stokes's theorem	3	Lecture	Black Board
1.4	Orthogonal curvilinear coordinates	3	Lecture	Black Board
1.5	Differential operators	2	Lecture	Black Board
1.6	Spherical polar coordinates	3	Chalk & Talk	Black Board
UNIT - 2 MATRICES				
2.1	Introduction-Review of algebraic operators on matrices	3	Chalk & Talk	Black Board
2.2	Sub matrices- Partitioning of matrices	3	Chalk & Talk	Black Board
2.3	Vectors as Matrices and vector spaces	3	Chalk & Talk	Black Board

2.4	The Eigen value problems	3	Chalk & Talk	Black Board
2.5	Linear transformations	3	Chalk & Talk	Black Board
UNIT -3 INTEGRAL TRANSFORMS				
3.1	Introduction - Fourier transform	1	Discussion	Black Board
3.2	Few properties of Fourier transform	1	Chalk & Talk	Black Board
3.3	Shifting property	2	Lecture	Black Board
3.4	Convolution property	2	Chalk & Talk	Black Board
3.5	Fourier transform of derivatives	2	Chalk & Talk	Black Board
3.6	Laplace transforms	2	Chalk & Talk	Black Board
3.7	Properties of Laplace transforms	2	Chalk & Talk	Black Board
3.8	Laplace transform of the derivative of a function	1	Chalk & Talk	Black Board
3.9	Inverse Laplace Theorem	1	Chalk & Talk	Black Board
3.10	Properties of Inverse Laplace transform	1	Chalk & Talk	Black Board
UNIT -4 SPECIAL FUNCTION I				
4.1	Definitions	1	Chalk & Talk	Black Board
4.2	Symmetry property of Beta Function	1	Chalk & Talk	Black Board

4.3	Evaluation of Beta Function	2	Chalk & Talk	Black Board
4.4	Transformation of Beta function	2	Chalk & Talk	Black Board
4.5	Evaluation of Gamma Function	2	Chalk & Talk	Black Board
4.6	Transformation of Gamma function	2	Chalk & Talk	Black Board
4.7	Legendre's differential equation and Legendre functions	1	Chalk & Talk	Black Board
4.8	Generating function of Legendre polynomial	1	Chalk & Talk	Black Board
4.9	Rodrigue formula	1	Chalk &Talk	Black Board
4.10	Orthogonal properties	1	Chalk & Talk	Black Board
4.11	Recurrence formula	1	Chalk & Talk	Black Board
UNIT - 5 SPECIAL FUNCTION II				
5.1	Bessel differential equations- Bessel functions of the first kind	2	Chalk & Talk	Black Board
5.2	Recurrence formula	1	Chalk & Talk	Black Board
5.3	Generating function	2	Chalk & Talk	Black Board
5.4	Hermite differential equations	2	Chalk &	Black

	and polynomials		Talk	Board
5.5	Generating function	2	Chalk & Talk	Black Board
5.6	Recurrence formula	2	Chalk & Talk	Black Board
5.7	Rodrigue formula-	2	Chalk & Talk	Black Board
5.8	Orthogonal properties	2	Chalk & Talk	Black Board

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA

Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Define and deduce gauss divergence and stokes theorem and solving problems on gauss divergence and stokes theorem	K1	PSO1& PSO2
CO 2	Discuss orthogonal curvilinear coordinates and spherical polar	K1, K2,	PSO3

	coordinates and solving problems using these coordinates		
CO 3	Explain special type of matrices and its Eigen value problems and illustrate the properties of Fourier and Laplace transforms	K2 & K4	PSO5
CO 4	Define Beta Functions and find its relations	K2, K3	PSO4& PSO5
CO5	Define Gamma Functions and find its relations	K2,K3	PSO4& PSO5

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	1	1
CO2	2	2	3	1	1
CO3	2	3	3	1	3
CO4	2	1	2	3	3
CO5	2	1	2	3	3

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	3	1	1	1
CO2	2	3	1	2
CO3	1	3	2	1
CO4	2	3	1	1
CO5	1	3	3	1

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. **Dr.G.DhevaShantha Kumari**
2. **Dr. M.Ragam**

Forwarded By

Dr. A. Sheela Vimala Rani

HoD's Signature & Name

I M.Sc.PHYSICS

SEMESTER –I

(*For those who joined in 2019 onwards*)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG1P2	Applied Electronics	Theory	5	3

COURSE DESCRIPTION

This course aims to introduce applied electronics to students, encompassing the concepts of semiconductor diode characteristics, Op-Amp characteristics, registers, counters, and analog to digital conversion techniques.

COURSE OBJECTIVES

The course curriculumis devised in a way to cover the theory giving a broader explanation on characteristics of Field Effect Transistors. It further includes basic circuitry involved for the linear and nonlinear analog systems comprising operational amplifier and its various applications. It also imparts knowledge on working principles of counters, registers and A/D conversion techniques.

UNIT I: FIELD EFFECT TRANSISTORS (15 HRS)

The junction field effect transistor- the Pinch off voltage (Vp)-the JFET volt-ampere characteristics-the FET small signal model-the Metal-oxide semiconductor FET(MOSFET) Biasing the FET- the FET as a Voltage-Variable Resistor-the Common source Amplifier at High frequencies-Common Drain amplifier at High frequencies.

UNIT II: LINEAR ANALOG SYSTEMS (15 HRS)

The Basic operational amplifier- The differential amplifier- The Emitter Coupled Differential amplifier-Offset Error Voltages and Currents-

Measurement of Operational amplifier Parameters. Basic Operational Amplifier Applications-Differential DC amplifier-Stable AC-Coupled Amplifier-Analog Integration and Differentiation- Electronic Analog Computation.

UNIT III: NON LINEAR ANALOG SYSTEMS (15 HRS)

Comparators-Sample-and-hold Circuits- Logarithmic Amplifiers-Anti log amplifier-Logarithmic Multiplier-Square wave generator-Pulse Generator-Triangle wave generator- Saw tooth generator-Regenerative Comparator (Schmitt Trigger)- Square wave generator&Pulse generator using 555 Timer.

UNIT IV: REGISTERS AND COUNTERS (15 HRS)

The Shift Register- Clocking- Serial- Parallel data transfer- End around carry- Shift- Right-Shift- Left Register- Ripple counter-Methods to improve Counter Speed- Non binary counters- Mod-3 counters-Mod 5 counters-lockout- The up-down ripple counter- the up-down synchronous counter-ring counters- sequence generator.

UNIT V:ANALOG TO DIGITAL CONVERSIONS (15 HRS)

Sampling theorem- time-division- multiplexing- quantization - the weighted resistor D/A converter- The R-2R ladder D/A converter – Inverted ladder D/A converter- A/D converters- A parallel- comparator type- successive Approximation converters.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Applications of electronics in the current technology

TEXT BOOK:

Jacob Millman, Cristos C. Halkias and Chetan D Parikh, (Second edition.
Seventh Reprint 2012)*Milman's Integrated Electronics: Analog and Digital Circuits and systems*- New Delhi: Tata McGraw Hill Publishing company Ltd.

Unit I Chapter: 10.1-10.5,10.8-10.11.

Unit II Chapters: 15.1-15.3,15.6,15.8,16.1- 16.5.

Unit III Chapter: 16.12-16.13,16.15-16.17,16.20

Herbert Taub & Donald Schilling, ***Digital integratedelectronics*, McGraw Hill Book Company.**

Unit IV Chapters: 10.1-10.7, 10.8-10.11, 10.14-10.17

Unit V Chapters: 14.1-14.6, 14.9, 14.12-14.13

BOOKS FOR REFERENCE

1.Thomas L.Floyd-PEARSON,*Electronic devices*

2.Albert Paul Malvino,*Digital Principles and Applications*, Tata Mc Graw Hill

3.Garud, *Electronic devices and Linear circuits* –Tata McGraw Hill

4.Boylestad, *Electronic devices and circuit theory* New Delhi Prentice Hall of India

5.Jain Digital electronics and Microprocessors – Problems and Solutions Tata Mc Graw Hill

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 FIELD EFFECT TRANSISTORS				
1.1	The junction field effect transistor- the Pinch off voltage (Vp)	3	Chalk & Talk	Black Board
1.2	JFET volt-ampere characteristics-the FET small signal model	2	Chalk & Talk	Black Board
1.3	Metal-oxide semiconductor FET(MOSFET)	3	Chalk & Talk	Black Board
1.4	Biasing the FET	4	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.5	FET as a Voltage- Variable Resistor	1	Lecture	LCD
1.6	Common source Amplifier at High frequencies	1	Chalk & Talk	Black Board
1.7	Common Drain Amplifier at High frequencies	1	Lecture	Black Board
UNIT -2 LINEAR ANALOG SYSTEMS				
2.1	The Basic operational amplifier-The differential amplifier	2	Chalk & Talk	Black Board
2.2	The Emitter Coupled Differential amplifier	3	Chalk & Talk	Black Board
2.3	-Offset Error Voltages and Currents-Measurement of Operational amplifier Parameters	2	Chalk & Talk	Black Board
2.4	. Basic Operational Amplifier applications	2	Chalk & Talk	Black Board
2.5	Analog Integration and Differentiation	2	Lecture	LCD
2.6	Differential DC amplifier-Stable AC-Coupled Amplifier	2	Chalk & Talk	Black Board
2.7	Electronic Analog Computation	2	Lecture	Black Board
UNIT -3 NON-LINEAR ANALOG SYSTEMS				
3.1	Comparators-Sample-and-hold Circuits	3	Chalk & Talk	Black Board
3.2	Logarithmic amplifiers-Anti log amplifier-Logarithmic Multiplier	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.3	Square wave generator-Pulse generator	3	Chalk & Talk	Black Board
3.4	Triangle wave generator	2	Chalk & Talk	Black Board
3.5	Saw tooth generator-Regenerative Comparator (Schmitt Trigger)	2	Chalk & Talk	Black Board
3.6	Square wave generator&Pulse generator using 555 Timer.	2	Chalk & Talk	Black Board
UNIT -4 REGISTERS AND COUNTERS				
4.1	The Shift Register- Clocking-Serial- Parallel data transfer-End around carry	2	Lecture	Black Board
4.2	Shift- right-shift- left register	2	Lecture	LCD
4.3	Ripple counter-Methods to improve Counter Speed	3	Chalk & Talk	Black Board
4.4	Non binary counters- Mod-3 counters-Mod 5 counters	2	Lecture	LCD
4.5	Lockout	1	Chalk & Talk	Black Board
4.6	The up-down ripple counter-the up-down synchronous counter	2	Lecture	LCD
4.7	Ring counters	1	Chalk & Talk	Black Board
4.8	Sequence Generator	2	Chalk & Talk	Black Board
UNIT -5 ANALOG TO DIGITAL CONVERSIONS				
5.1	Sampling theorem- time-division- multiplexing-quantization	3	Chalk & Talk	Black Board
5.2	The weighted resistor D/A converter	3	Lecture	LCD

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.3	The R-2R ladder D/A converter	3	Chalk & Talk	Black Board
5.4	Inverted ladder D/A converter- A/D converters	3	Chalk & Talk	Black Board
5.5	A parallel- comparator type- successive Approximation converters	2	Chalk & Talk	Black Board

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA

Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO1	Distinguish between BJT and FET and explain the fundamental concepts of diode, BJT and transistor biasing to understand the small signal	K1, K2	PSO1,PSO2& PSO3

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
	behaviour of FET for amplification applications		
CO2	Outline the basics of linear and nonlinear analog systems	K1, K2	PSO5
CO3	Describe the design concepts of counters and shift registers	K2, K3	PSO2,PSO3
CO4	Apply the theory of OPAMP to design the linear and nonlinear applications of it.	K2, K3	PSO4,PSO5
CO5	Describe the design concepts of counters and shift registers. Demonstrate the various techniques to develop A/D and D/A converters	K2, K3	PSO4,PSO5

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**3**	**1**	**2**
CO2	**2**	**2**	**1**	**2**	**3**
CO3	**2**	**3**	**3**	**1**	**2**
CO4	**1**	**2**	**2**	**3**	**3**
CO5	**2**	**1**	**2**	**3**	**3**

Mapping of C0s with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	2	3	2	2
CO2	2	3	3	2
CO3	2	3	2	2
CO4	2	2	3	2
CO5	2	3	3	2

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER

R.ALPHONSA FERNANDO

Forwarded By

Dr. A. Sheela Vimala Rani

HoD's Signature & Name

I M.Sc.PHYSICS

SEMESTER –I

(*For those who joined in 2019 onwards*)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG1P3	CLASSICAL MECHANICS	Theory	5	3

COURSE DESCRIPTION

This course imparts a thorough knowledge of Mechanics of single particle and a system of particles, applying various classical theories. This would help them to analyse any system using classical mechanics.

COURSE OBJECTIVES

To enable the student to learn different types of constraints, to derive Lagrange's equation from a variational principle, to understand the two body central force problem, to discuss scattering in central force field, to have knowledge about small oscillations, conservation laws and symmetry, canonical transformations and Poisson brackets.

UNITS

UNIT –I Lagrangian Methods (15 HRS)

Mechanics of a particle- Mechanics of a system of particles- constraints- D'Alembert's principle and Lagrange's equations- Velocity - dependent potentials and the dissipation function- simple application of the Lagrangian formulation.

UNIT –II Variational principles andLagrange's equations (15 HRS)

Hamilton's principle- some techniques of the calculus of variations- derivation of Lagrange's equations from Hamilton's Principle- Extension of Hamilton's principle to nonholonomic systems- conservation theorems and symmetry properties.

UNIT –III Two body central force problem (15 HRS)

Reduction to the equivalent one-body problem- the equations of motion and first integrals-the equivalent one- dimensional problem and classification of orbits- the virial theorem- the differential equations for the orbit, and integrable power- law potentials- conditions for closed orbits (Bertrand's theorem)- the Kepler problem: inverse square law of force- the motion in time in the Kepler problem- Scattering in a central force field- transformation of the scattering problem to laboratory coordinates.

UNIT –IV Small oscillations (15HRS)

Formulation of the problem- Eigen value equation and the principle axis transformation- frequencies of free vibrations- normal coordinates- Free vibrations of a linear tri atomic molecule- Forced vibration and the effect of dissipative forces.

UNIT –V Hamilton equations of motion (15 HRS)

Legendre transformations and the Hamilton equations of motion –Cyclic coordinates and conservation theorems- Routh's procedure- Derivation of Hamilton's equations from a variational principle- The principle of least action.

Canonical transformation

The equations of canonical transformations – Examples of canonical transformations- The symplectic approach to canonical transformations - equations of motion in the poisson bracket formulation.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Discussion on the current Space Missions of ISRO.

REFERENCES

TEXT BOOK:

1. Herbert Goldstein, Classical Mechanics- Second Edition, Narosa Publishing House- New Delhi.

Unit1 - Chapter:1

Unit 2 - Chapter: 2.1-2.4,2.6,

Unit 3 - Chapter:3.1-3.8,3.10,3.11

Unit 4 - Chapter:6

Unit5 - Chapter:8.1(tillP343)8.2,8.3(till P352),8.5,8.6,9.1-9.3(tillP391)9.5(till P406)

REFERENCE BOOKS:

1. G.Arul Dhas, Classical Mechanics, PHI

2., N.C. Rana & P.S. Joag,Classical Mechanics, TMH

3. Guta Kumar & Sharma,Classical Mechanics, PragathiPrakashan

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 LAGRANGIAN METHODS				
1.1	Mechanics of a particle	2	Chalk & Talk	Black Board
1.2	Mechanics of a system of particles	2	Chalk & Talk	Black Board
1.3	Constraints-Different types	1	Lecture	Black Board
1.4	Examples	2	Lecture	Black Board
1.5	D'Alembert's principle and Lagrange's equations	2	Chalk & Talk	Black Board
1.6	Velocity - dependent potentials and the dissipation function	2	Chalk & Talk	Black Board
1.7	Simple application of the Lagrangian formulation- single particle in space	2	Chalk & Talk	Black Board
1.8	Atwood's machine, A bead sliding on a rotating wire	2	Chalk & Talk	Black Board
UNIT -2 VARIATIONAL PRINCIPLES ANDLAGRANGE'S EQUATIONS				
2.1	Hamilton's principle	2	Lecture	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
				Board
2.2	Some techniques of the calculus of variations	2	Chalk & Talk	Black Board
2.3	Derivation of Lagrange's equations from Hamilton's Principle	2	Chalk & Talk	Black Board
2.4	Applications-Shortest distance between two points in a plane	2	Chalk & Talk	Black Board
2.5	Minimum surface of revolution and other examples	1	Chalk & Talk	Black Board
2.6	The Brachistochrone problem	2	Chalk & Talk	Black Board
2.7	Extension of Hamilton's principle to nonholonomic systems	2	Chalk & Talk	Black Board
2.8	Conservation theorems and symmetry properties.	2	Chalk & Talk	Black Board
UNIT -3 TWO BODY CENTRAL FORCE PROBLEM				
3.1	Reduction to the equivalent one-body problem	1	Chalk & Talk	Black Board
3.2	Equations of motion and first integrals	2	Chalk & Talk	Black Board
3.3	The equivalent one- dimensional problem and classification of orbits	2	Chalk & Talk	Black Board
3.4	The virial theorem	1	Seminar	LCD
3.5	The differential equations for the orbit, and integrable power- law potentials	2	Chalk & Talk	Black Board
3.6	Conditions for closed orbits (Bertrand's theorem)	2	Seminar	LCD

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.7	The Kepler problem: inverse square law of force- the motion in time in the Kepler problem	2	Chalk & Talk	Black Board
3.8	Scattering in a central force field- transformation of the scattering problem to laboratory coordinates.	3	Chalk & Talk	Black Board
UNIT -4 SMALL OSCILLATIONS				
4.1	Formulation of the problem	2	Seminar	Black Board
4.2	Types of equilibrium	2	Seminar	LCD
4.3	Eigen value equation and the principle axis transformation	3	Chalk & Talk	Black Board
4.3	Frequencies of free vibrations- normal coordinates	2	Seminar	LCD
4.4	Routh's procedure	2	Chalk & Talk	Black Board
4.5	Free vibrations of a linear tri atomic molecule	2	Seminar	LCD
4.6	Forced vibration and the effect of dissipative forces.	2	Chalk & Talk	Black Board
UNIT -5 HAMILTON EQUATIONS OF MOTION				
5.1	Legendre transformations and the Hamilton equations of motion	2	Chalk & Talk	Black Board
5.2	Cyclic coordinates and conservation theorems	1	Seminar	LCD
5.3	Routh's procedure	2	Chalk & Talk	Black Board
5.4	Derivation of Hamilton's equations from a variational principle	2	Chalk & Talk	Black Board
5.5	The principle of least action	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.6	The equations of canonical transformations – Examples of canonical transformations	2	Seminar	LCD
5.	The symplectic approach to canonical transformations -	2	Chalk & Talk	Black Board
5.8	Equations of motion in the Poisson bracket formulation.	2	Chalk & Talk	Black Board

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA

Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

****The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To identify different types of constraints imposed on systems.	K1, K2	PSO1& PSO2

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 2	To derive Lagrange's equation from Hamilton's variational principle and to write the equation of motion for any given system according to Lagrangian formulation.	K2, K3	PSO1&PSO4
CO 3	To explain the two body central force problem and classification of orbits and hence to discuss scattering in a central force field.	K2 & K3	PSO2&PSO3
CO 4	To apply the theory of small oscillations to a linear triatomic moleculeand get the normal modes and normal frequencies of the same.	K2, K3 & K4	PSO3 & PSO4
CO 5	To derive Hamilton's equations using Legendre transformation. To evaluate the connection between conservation theorems and symmetry properties of the system. To solve problems related to canonical transformations and Poisson brackets.	K1 , K2	PSO1,PSO4 &PSO5

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**2**	**1**	**1**
CO2	**3**	**1**	**2**	**3**	**1**
CO3	**2**	**3**	**3**	**1**	**1**
CO4	**2**	**1**	**3**	**3**	**1**
CO5	**3**	**1**	**1**	**3**	**3**

CO/ PO	PO1	PO2	PO3	PO4
CO1	3	1	1	1
CO2	2	3	1	1
CO3	1	3	2	1
CO4	2	3	1	1
CO5	1	3	3	1

Mapping of COs with POs

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. **Dr. MathaviManisekar**
2. **Dr. Ancemma Joseph**

Forwarded By

Dr. A. Sheela Vimala Rani

HoD's Signature & Name

I M.Sc. PHYSICS

SEMESTER –I

For those who joined in 2021 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	21PG1P4	Applied Optics	Theory	4	3

COURSE DESCRIPTION

The aim of this course is to provide an overview of the fields of laser, nonlinear optics, Fourier optics and holography.

COURSE OBJECTIVES

This course gives a description of fundamental concepts of nonlinear optics encompassing laser theory, harmonic generation principles, optical mixing, Fourier optics, optical signal processing and holography.

UNIT –I **(12 HRS)**

Properties of Laser beams and types of lasers

Introduction – Coherence properties of Laser light – Ruby Laser – The He-Ne Laser – Four level solid state Lasers – Carbon dioxide Lasers – Dye Lasers – Semiconductor Lasers

UNIT –II **(12 HRS)**

Nonlinear Optics

Introduction – Second order nonlinear phenomena – Wave Propagation in nonlinear media – Optical second order harmonic generation – Optical mixing – frequency up conversion – Optical mixing in vapour

UNIT –III **(12 HRS)**

Fourier Optics

Analysis of Two – Dimensional signals and systems: Fourier Analysis in Two Dimensions- Linear systems- Two Dimensional sampling theory: The Whittaker – Shannon sampling Theorem.

Foundation of scalar Diffraction Theory: Historical introduction- From a vector to scalar theory- some Mathematical Preliminaries: The Helmholtz

Equation, Green's Theorem, the integral theorem of Helmholtz and Kirchhoff.

UNIT –IV **(12 HRS)**

Fresnel and Fraunhofer Diffraction

The Huygens – Fresnel Principle in rectangular Coordinates. The Fresnel Approximation- The Fraunhofer Approximation-Examples of Fraunhofer Diffraction Patterns.

Wave – optics analysis of coherent optical systems: A thin lens as a Phase Transformation and Fourier transforming properties of lenses.

UNIT –V **(12 HRS)**

Holography

Historical Introduction- The wavefront reconstruction problem: Recording amplitude and Phase, The recording medium, Reconstruction of the original wavefront, linearity of the Holographic Process, image formation of Holography. The Gabor Hologram – The Leith- Upatnieks Hologram.

UNIT –VI DYNAMISM(For CIA only)

Discussion on the application of lasers and nonlinear optical devices.

REFERENCES

UNIT I - Lasers Theory and Applications -K.Thyagarajan and A.K.Ghatak . Chapter: 9

UNITII- Topics in Modern Optics – A.S. Parasnis, K.R.Sharma and R.K.Thareja , New Age International Publishers , Chapter: 13 (13.1-13.7)

UNIT III - Introduction to Fourier Optics – joseph W.Goodman- second edition- Chapter 2 : 2.1, 2.3, 2.4. Chapter 3: 3.1 -3.3

UNIT IV – Introduction to Fourier Optics – joseph W.Goodman- second edition- chapter 4: 4.1.2 - 4.4.

UNIT V - Introduction to Fourier Optics – joseph W.Goodman- second edition, Holography - Chapter 9 : 9.1 – 9.4.

Digital Open Educational Resources (DOER) :

1. https://en.wikipedia.org/wiki/Laser#:~:text=A%20laser%20is%20a%20device,in%201960%20by%20Theodore%20H.
2. https://en.wikipedia.org/wiki/Holography#:~:text=Holography%20is%20a%20technique%20that,recorded%20and%20later%20re%2Dconstr

ucted.&text=A%20hologram%20is%20made%20by,recorded%20on%20a%20physical%20medium.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 PROPERTIES OF LASER BEAMS AND TYPES OF LASERS				
1.1	Introduction	2	Chalk & Talk	Black Board
1.2	Coherence properties of Laser light	2	Chalk & Talk	Black Board
1.3	Ruby Laser	2	Lecture	Black Board
1.4	The He-Ne Laser	2	Lecture	Black Board
1.5	Four level solid state Lasers	1	Chalk & Talk	Black Board
1.6	Carbon dioxide Lasers	1	Chalk & Talk	Black Board
1.7	Dye Lasers	1	Chalk & Talk	Black Board
1.8	Semiconductor Lasers	1	Chalk & Talk	Black Board
UNIT -2 NONLINEAR OPTICS				
2.1	Introduction	3	Lecture	Black Board
2.2	Second order nonlinear phenomena	2	Chalk & Talk	Black Board
2.3	Wave Propagation in nonlinear media	3	Chalk & Talk	Black Board
2.4	Optical second order harmonic generation	1	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.5	Frequency up conversion	1	lecture	PPT
2.6	Optical mixing	1	Chalk & Talk	Black Board
2.7	Optical mixing in vapour	1	Chalk & Talk	Black Board
UNIT -3 FOURIER OPTICS				
3.1	Introduction to Analysis of Two – Dimensional signals and systems	1	Chalk & Talk	Black Board
3.2	Fourier Analysis in Two Dimensions	2	Chalk & Talk	Black Board
3.3	Linear systems	1	Chalk & Talk	Black Board
3.4	Two Dimensional sampling theory: The whittaker Shannon sampling Theorem.	2	Seminar	LCD
3.5	Foundation of scalar Diffraction Theory	1	Chalk & Talk	Black Board
3.6	Historical introduction	1	Seminar	LCD
3.7	From a vector to scalar theory	1	Chalk & Talk	Black Board
3.8	Some Mathematical Preliminaries: The Helmholtz Equation, Green's Theorem,	2	Chalk & Talk	Black Board
3.9	The integral theorem of Helmholtz and Kirchhoff.	1	Chalk & Talk	Black Board
UNIT -4 FRESNEL AND FRAUNHOFER DIFFRACTION				
4.1	The Huygens	1	Seminar	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.2	Fresnel Principle in rectangular Coordinates	2	Chalk & Talk	Black Board
4.3	The Fresnel Approximation	2	Chalk & Talk	Black Board
4.4	The Fraunhofer Approximation	2	Chalk & Talk	Black Board
4.5	Examples of Fraunhofer Diffraction Patterns	1	Chalk & Talk	Black Board
4.6	A thin lens as a Phase Transformation	1	Seminar	PPT
4.7	Fourier transforming properties of lenses.	3	Seminar	PPT
UNIT -5 HOLOGRAPHY				
5.1	Introduction to Holography	1	Chalk & Talk	Black Board
5.2	Historical Introduction	1	Seminar	LCD
5.3	The wavefront reconstruction problem: Recording amplitude and Phase	3	Chalk & Talk	Black Board
5.4	The recording medium, Reconstruction of the original wavefront	2	Chalk & Talk	Black Board
5.5	Linearity of the Holographic Process	1	Chalk & Talk	Black Board
5.6	Image formation of Holography	1	Seminar	PPT
5.7	The Gabor Hologram	2	Chalk & Talk	Black Board
5.8	The Leith- Upatnieks Hologram.	1	Chalk & Talk	Black Board

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

The best out of two will be taken into account

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

S.NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Understand and explain the properties of Laser beams and types of lasers	K2 & K3	PSO1& PSO4
CO 2	Describe the basic concepts of nonlinear optics and principles of second harmonic generation and optical mixing	K2&K4	PSO2&PSO3
CO 3	Acquire knowledge about the techniques of Fourier optics inclusive of diffraction	K2&K3	PSO1& PSO3
CO 4	Understand the fundamentals of optical signal processing and its techniques of analysis	K2&K4	PSO1 &PSO5
CO 5	Describe the principles and	K2 &K4	PSO1& PSO2

S.NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
	practical problems of holography		

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	3	2
CO2	2	3	3	2	1
CO3	3	2	3	1	2
CO4	3	2	2	1	3
CO5	3	3	2	1	2

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	2	1	2	3
CO2	1	3	3	2
CO3	3	2	2	1
CO4	3	2	1	1
CO5	3	3	3	1

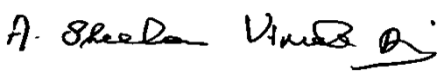
Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. **Dr.M.V. Leena Chandra**
2. **Dr.R.Jothi Mani**

Forwarded By



Dr. A. Sheela Vimala Rani

HoD's Signature & Name

I M.Sc.PHYSICS

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PAPH	19PG1P5	Non Electronics	Practical	4	2

COURSE DESCRIPTION

The course provides hands on training to work with fiber, Laser and determination of the young's modulus, mutual inductance.

COURSE OBJECTIVE/S

This course offers opportunity to handle the laboratory equipment's and develop lab skills in non-electronics experiments

LIST OF EXPERIMENTS

1. Determination of splice loss of the given fiber.
2. Determination of refractive Index of the liquid at various concentrations using laser.
3. Determination of bending loss of the given fiber.
4. Study of Fraunhofer diffraction pattern for various apertures
5. Determination of Young's modulus and Poisson's ratio of the given glass plate by employing elliptical fringes.
6. Determination of mutual inductance of the given pair of coils for various angles byAnderson's bridge.
7. Determination of absorption coefficient of transparent material of various thickness
8. Study of solar panel
9. Determination of Mass susceptibility of given solid using Guoy's Balance
10. Determination of resolving power of prism and grating
11. Study of specific rotation – Polarimeter
12. Dielectric constant of various liquids

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Dr. A. Sheela Vimala Rani
HoD's Signature & Name

I M.Sc.PHYSICS

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PAPH	19PG1P6	Electronics	Practical	4	2

COURSE DESCRIPTION

The course provides hands on training to work with counters, multivibrators and OP-AMP circuits, flip flops and microprocessor.

COURSE OBJECTIVE/S

This course offers opportunity to handle the laboratory equipment's and develop lab skills in electronics experiments

LIST OF EXPERIMENTS

1. K-map simplification and implementation of logic gate using NAND and NOR gates.
2. Flip-Flops- RS, $\bar{R}S$ using IC 7400, IC 7402. (Construction and verification of Truth tables.)
3. J-K, D, T using IC 7410, IC 7404 (Construction and verification of truth tables)
4. Op-amp parameters using IC-741. (Closed loop gain, Output Resistance, CMRR, Input bias current)
5. OPAMP Applications
6. Binary counter using IC 7490 (Construction and verification of Truth tables.)
7. IC Regulated Dual power supply (Construction& Measurement of DC Output voltage.
8. Solving Boolean expressions to simplify the circuits.
9. MICROPROCESSOR -8086 Programs:

• To find the factorial of a given number
• Sum of a series of 16-bit data.
• Word move from REP instruction
• Block move using REP instruction.

10. Shift Register (Serial in -parallel out) using IC 7400, IC 7404, IC 74164.(Construction & study the working of Shift Register)

Forwarded By

Dr. A. Sheela Vimala Rani
HoD's Signature & Name

I M.Sc. PHYSICS

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG2P7	ADVANCED MATHEMATICAL PHYSICS	Theory	5	3

COURSE DESCRIPTION: This course emphasise the basic concepts and applications of Mathematical Physics which involves complex variables, tensors, Dirac delta, Greens function and group theory

COURSE OBJECTIVES

This course provides the introduction of advanced mathematical tools such as complex variables, tensor analysis, Dirac delta and Green's functions and group theory

UNIT –I COMPLEX VARIABLES: (15HRS)

Complex numbers –review of Algebraic operations on complex numbers-Complex Conjugates-Modulus and argument of a complex numbers-definition- Cauchy-Riemann conditions - Cauchy-Riemann differential equations- Cauchy's integral theorem- Cauchy's integral formula- Laurent's series – singularities of an analytic function – Cauchy residue theorem

UNIT –II TENSOR ANALYSIS (15 HRS)

Introduction- Algebra of tensors- Quotient Law-Fundamental tensor – Cartesian tensors- Four vectors in special relativity-Covariant formulation of electrodynamics.**(SELF STUDY)**

UNIT –III DIRAC DELTA FUNCTIONS & GREEN'S FUNCTION (15 HRS)

Introduction-Green's function for the Sturn-Liouville operator- Series expansions for G (x /ε)- Concepts of theory of Distributions: Strongly peaked function and the Dirac- Delta sequences- The Calculus- Representation of Delta Functions-Application of the Calculus.

UNIT –IV ABSTRACT GROUP THEORY: (15 HRS)

Defining properties of a group – some examples of groups – subgroups – classes – Molecular symmetry and the symmetry groups – symmetry elements and operations – symmetry planes and reflections – the inversion centre – proper axes and proper rotations – improper axes and improper rotations – products of symmetry operations – equivalent symmetry elements and equivalent atoms – general relations among symmetry elements and operations – symmetry elements and optical isomerism – the symmetry point groups – symmetries with multiple higher order axes – a systematic procedure for symmetry classification of molecules – illustrative examples – classes of symmetry operations

UNIT –VTHEORY OF GROUP REPRESENTATION: (15 HRS)

Representations of groups – the great Orthogonality theorem and its consequences - character tables – representations for cyclic groups – wave functions as bases for irreducible representation – the direct product

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Applications of Tensors for physical problems, molecular symmetry and operations of various molecules.

REFERENCES:

BOOKS FOR STUDY:

Unit 1:- Mathematical Physics with classical mechanics by Satya Prakash Sultan Chand and Sons, Fourth Revised and enlarged edition 2002. Chapter: 5, Secs: 5.1-5.4, 5.9, 5.10, 5.14, 5.16, 5.21, 5.22, 5. 24

Unit 2:– Matrices and Tensors in Physics by A.W.Joshi - Wiley Eastern Ltd II – Tensor analysis :Chapters: 15-21

Unit 3: -Mathematical Physics - Butkov (Dirac Delta function and Green's function)

Chapters: 6 &12, Secs: 6.1-6.5,12.1-12.3

Unit 4 & Unit 5: - Chemical Applications of group theory by F. Albert Cotton – II ed. Wiley Eastern Ltd. Chapters:2,3,4& 5, Secs: 2.1- 2.4, 3.1-3.15, 4.2- 4.5, 5.1,5.2

BOOKS FORREFERENCE:

1. Applied Mathematics for Engineers and Physicists– A.Pipes&R. Harvill-IIIedition- McGraw Hill international Book company- New Delhi.

2. Group theory and Quantum Mechanics- Michael Tinkham.

3. Essential Mathematical methods for Physicists- Hans J. Weber and George B.Arfken Academic Press.

4.Molecular Structure and Spectroscopy (Second Edition)-by G.Aruldhass –PHI Learning Private Limited

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT –I COMPLEX VARIABLES				
1.1	Complex numbers	1	Chalk & Talk	Black Board
1.2	Review of Algebraic operations on complex numbers	1	Chalk & Talk	Black Board
1.3	Complex Conjugates	1	Lecture	Black Board
1.4	Modulus and argument of a complex numbers	1	Lecture	Black Board
1.5	Definition	1	Lecture	Black Board
1.6	Cauchy-Riemann differential equations	3	Chalk & Talk	Black Board

1.7	Cauchy's integral theorem-	2	Chalk & Talk	Chalk & Talk
1.8	Cauchy's integral formula-	2	Chalk & Talk	Chalk & Talk
1.9	Laurent's series	1	Chalk & Talk	Chalk & Talk
1.10	Singularities of an analytic function	1	Chalk & Talk	Chalk & Talk
1.11	Cauchy residue theorem	1	Chalk & Talk	Chalk & Talk
UNIT – 2 TENSOR ANALYSIS				
2.1	Introduction	1	Chalk & Talk	Black Board
2.2	Algebra of tensors- Quotient Law	3	Chalk & Talk	Black Board
2.3	Fundamental tensor – Cartesian tensors	3	Chalk & Talk	Black Board
2.4	Four vectors in special relativity	4	Chalk & Talk	Black Board
2.5	Covariant formulation of electrodynamics	4	Chalk & Talk	Black Board
UNIT -3DIRAC DELTA FUNCTIONS & GREEN'S FUNCTION				
3.1	Introduction	1	Discussion	Black Board
3.2	Green's function for the Sturn-Liouville operator	2	Chalk & Talk	Black Board
3.3	Series expansions for G (x /ε)-	2	Lecture	Black Board
3.4	Concepts of theory of Distributions	2	Chalk & Talk	Black Board
3.5	Strongly peaked function and the Dirac- Delta sequences-	2	Chalk & Talk	Black Board

3.6	The Calculus	2	Chalk & Talk	Black Board
3.7	Representation of Delta Functions-	2	Chalk & Talk	Black Board
3.8	Application of the Calculus.	2	Chalk & Talk	Black Board
UNIT -4 ABSTRACT GROUP THEORY				
4.1	Defining properties of a group	1	Chalk & Talk	Black Board
4.2	Some examples of groups	1	Chalk & Talk	Black Board
4.3	Subgroups	1	Chalk & Talk	Black Board
4.4	Classes	1	Chalk & Talk	Black Board
4.5	Molecular symmetry and the symmetry groups	1	Chalk & Talk	Black Board
4.6	Symmetry elements and operations	1	Chalk & Talk	Black Board
4.7	Symmetry planes and reflections	1	Chalk & Talk	Black Board
4.8	The inversion centre	1	Chalk & Talk	Black Board
4.9	Proper axes and proper rotations	1	Chalk & Talk	Black Board
4.10	Improper axes and improper rotations - Products of symmetry operations	1	Chalk & Talk	Black Board
4.11	Equivalent symmetry elements and equivalent atoms	1	Chalk & Talk	Black Board

4.12	General relations among symmetry elements and operations	1	Chalk & Talk	Black Board
4.13	Symmetry elements and optical isomerism - The symmetry point groups	1	Chalk & Talk	Black Board
4.14	Symmetries with multiple higher order axes - Classes of symmetry - Operations	1	Chalk & Talk	Black Board
4.15	A systematic procedure for symmetry classification of molecules – Illustrative examples	1	Chalk & Talk	Black Board
UNIT-5 THEORY OF GROUP REPRESENTATION				
5.1	Representations of groups	3	Chalk & Talk	Black Board
5.2	The great Orthogonality theorem and its consequences	3	Chalk & Talk	Black Board
5.3	Character tables	4	Chalk & Talk	Black Board
5.4	Representations for cyclic groups	2	Chalk & Talk	Black Board
5.5	Wave functions as bases for irreducible representation	2	Chalk & Talk	Black Board
5.6	The direct product	1	Chalk & Talk	Black Board

Levels	**C1**	**C2**	**C3**	**C4**	**C5**	**Total Schola**	**Non Schola**	**CIA Total**	**% of**

						stic Marks	stic Marks C6		Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA

Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

**** The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Perform algebra with complex numbers and to Identify and determine the differentiable functions and find its derivatives	K1	PSO1& PSO2
CO 2	Identify the singularities of a function and determine whether they are removable poles are essential	K1, K2,	PSO3
CO 3	Perform algebra of tensors and apply four vectors in special relativity and the formulation of electrodynamics	K2 & K4	PSO5

CO 4	Discuss greens function for Sturn – Liouville operator and to compute dirac delta functions Green's functions and solving problems	K2 & K3	PSO4& PSO5
CO 5	Represent delta function and apply delta calculus	K3&K4	PSO3&PSO5

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	1	1
CO2	2	2	3	1	1
CO3	2	2	2	3	3
CO4	2	1	2	3	3
CO5	2	1	3	2	3

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	3	1	1	1
CO2	2	3	1	2
CO3	1	3	2	1
CO4	2	3	1	1
CO5	1	3	3	1

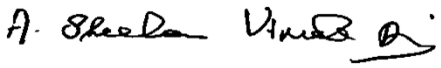
Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2** ♦ Weakly Correlated -**1**

COURSE DESIGNER:

1.Dr.G. DhevaShantha Kumari

2.Dr. M.Ragam

Forwarded By



Dr. A. Sheela Vimala Rani

HoD'sSignature & Name

I M.Sc. PHYSICS

SEMESTER –II

(*For those who joined in 2019 onwards*)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG2P8	Quantum Mechanics	Theory	5	3

COURSE DESCRIPTION

This course introduces Schrodinger equation, general formalism of quantum mechanics, exactly soluble Eigen value problems, representations and angular momentum.

COURSE OBJECTIVES

To enable the student to write the Schrodinger's equation and solve it for a free particle, a particle in a potential well and a simple harmonic oscillator; to have knowledge about self adjoint operators, degeneracy of eigen values, normalization and closure property of wave functions, to discuss the problems in Dirac notation, to know the matrix representation of angular momentum, addition of angular momenta and to find the ClebshGorden coefficients.

UNIT –I THE SCHRODINGER EQUATION & STATIONARY STATES:

(15 HRS)

The Schrodinger Equation:A free particle in one dimension- Generalisation to three dimension- the operator correspondence, and the Schrodinger equation for a particle subject to forces.

Physical Interpretation and conditions on: Normalization and probability interpretation- non-normalizable probability – expectation values; Ehrenfest's theorem- Admissibility conditions on the wave functions

Stationary states and Energy Spectra: The time-independent schrodinger equation-A particle in a square well potential- Bound states in a square well: (E < O)

Admissible solutions of wave equation (b) the energy eigen values- discrete spectrum (c) the energy eigen functions: parity (d) penetrations into classically forbidden regions- **The square well: non localized states (E> O) – square potential barrier: (a) Quantum mechanical tunnelling (b) Reflection at potential barriers and wells (Self Study).**

UNIT –II GENERAL FORMALISM OF WAVE MACHANICS: (15 HRS)

The fundamental postulates of wave mechanics: (a) Representation of states (b) Representation of Dynamical variables: Expectation values, Observables- The adjoint of an operator and self- Adjointness- the eigenvalue problem: Degeneracy- Eigenvalues and eigenfunctions of self- adjoint operators- the Dirac Delta function- observables: Completeness and normalization of eigenfunction- closure- physical interpretation of eigenvalues, eigenfunction, and expansion coefficients- Momentum eigenfunctions : wave functions in momentum space: (a) self-adjointness and reality of eigen values (b) normalization and closure (c) the wave function and operations in momentum space – the uncertainty principle- states with minimum value for uncertainty product- commuting observables : removal of Degeneracy- Evolution of system with time: Constants of the motion – **Non-interacting and interacting systems- symmetric and antisymmetric wave functions (b) relation between type of symmetry and statistics: the exclusion principle (Self study).**

UNIT –III EXACTLY SOLUBLE EIGEN VALUE PROBLEMS: (15HRS)

The simple Harmonic Oscillator:

The Schrodinger equationand energy eigenvalues – the energy eigenfunctions: (a) Series solution: Asymptotic Behaviour (b) Orthonormality- properties of stationary states- **The abstract operator method:** (a) The ladder (or Raising and lowering) Operators (b) the eigen value spectrum (c) the energy eigen functions – coherent states.

Angular momentum and parity:

The angular momentum operators- the eigen value equations for L: separation of variables- admissibility conditions on solutions: eigen values- the eigen functions spherical harmonics- physical interpretation parity

angular momentum in stationary states of systems with spherical symmetry: **(a) The rigid rotator (b) A particle in a central potential: The Radial equation (c) the radial wave function (Self study).**

UNIT–IV REPRESENTATIONS, TRANSFORMATIONS & SYMMETRIES (15HRS)

State vectors and wave function – the 62ilbert space of state vectors: Dirac Notation: (a) state vectors and their conjugates (b) norm and scalar product (c) Basis in Hilbert space- Dynamical variables and linear operators: (a) Abstract operators: the Quantum condition (b) the adjoint of an operator, self adjointness 9c) eigen values and eigenvector (d) expansion of the identity (Self study): Projection operators (e) Unitary Operators – Representations: (a) Representation of state vectors : the wave function (b) Dynamical variables as Matrix operators (c) products of operators : the quantum condition (d) self adjointness and hermiticity (e) Diagonalization- Continuous Basis – the Schrodinger representation – Degeneracy : Labelling by commuting observables- change of Basis : Unitary transformations- unitary transformations induced by change of co-ordinate system- algebra of Rotation generators- transformation of Dynamical Variables – **Symmetries and conservation laws-space inversion : (a) intrinsic parity (b) the unitary Operator of space inversion (c) parity non conservation – time reversal (Self study).**

UNIT –V ANGULAR MOMENTUM (15HRS)

The eigenvalue spectrum- Matrix representation of J in the jm basis – spin angular momentum☹a) spin-1/2 (b) spin-1 (c) total wave function-nonrelativistic Hamiltonian including spin- **addition of angular momenta-clebsch-Gordon coefficients: determination of $< j_1; j- j_1|jj>$ (Self study).**

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Quantum Mechanics in daily life including application of Quantum mechanics to innovations made in the field of Fiber Optics, Solar Cells, Telecommunication, GPS, Microscopy, Medical diagnosis and treatment, etc.

TEXT BOOK:

P.M. Mathews and K.Venkatesan, A textbook of Quantum Mechanics, Tata Mc Graw Hill publishing Company Ltd.- New Delhi. 2012

Unit1: 2.1-2.13

Unit 2: 3.2-3.16

Unit 3: 4.1-4.12 upto radial wave equation only.

Unit 4: 7

Unit 5: 8.1-8.5, 8.6(d) only,

REFERENCES:

1.L.I.Schiff ,Quantum Mechanics , McGraw Hill

2.B.Craseman and J.D.Powell,Quantum Mechanics (Addison Wesley)

3. Devanathan, Quantum Mechanics.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 THE SCHRODINGER EQUATION & STATIONARY STATES:				
1.1	The Schrodinger Equation:A free particle in one dimension-Generalisation to three dimension	2	Chalk & Talk	Black Board
1.2	The operator correspondence, and the Schrodinger equation for a particle subject to forces.	1	Chalk & Talk	Black Board
1.3	Physical Interpretation and conditions on: Normalization and probability interpretation-non-normalizable probability	2	Chalk & Talk	Black Board
1.4	Expectation values; Ehrenfest's theorem- Admissibility conditions on the wave functions	2	Chalk & Talk	Black Board
1.5	The time-independent schrodinger equation	1	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.6	Bound states in a square well : (E < O)	2	Chalk & Talk	Black Board
1.7	non localized states (E> O)	2	Chalk & Talk	Black Board
1.8	square potential barrier	3	Chalk & Talk	Black Board
UNIT -2	**GENERAL FORMALISM OF WAVE MACHANICS:**			
2.1	The fundamental postulates of wave mechanics:	2	Chalk & Talk	Black Board
2.2	The adjoint of an operator and self- Adjointness	2	Chalk & Talk	Black Board
2.3	observables: Completeness and normalization of eigenfunction-closure	2	Chalk & Talk	Black Board
2.4	Momentum eigenfunctions	1	Chalk & Talk	Black Board
2.5	(a) Self-adjointness and reality of eigen values (b) Normalization and closure (c) the wave function and operations in momentum space	2	Chalk & Talk	Black Board
2.6	The uncertainty principle	2	Chalk & Talk	Black Board
2.7	Evolution of system with time: Constants of the motion	2	Chalk & Talk	Black Board
2.8	Relation between type of symmetry and statistics: the exclusion principle.	2	Chalk & Talk	Black Board
UNIT -3 EXACTLY SOLUBLE EIGEN VALUE PROBLEMS:				
3.1	The simple Harmonic Oscillator	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.2	The abstract operator method	4	Chalk & Talk	Black Board
3.3	The angular momentum operators	4	Chalk & Talk	Black Board
3.4	parity	2	Chalk & Talk	Black Board
3.5	systems with spherical symmetry	2	Chalk & Talk	Black Board
UNIT -4 REPRESENTATIONS . TRANSFORMATIONS & SYMMETRIES				
4.1	State vectors and wave function	2	Chalk & Talk	Black Board
4.2	Dynamical variables and linear operators	3	Chalk & Talk	Black Board
4.3	Representation of state vectors	2	Chalk & Talk	Black Board
4.4	Continuous Basis – the Schrodinger representation	2	Chalk & Talk	Black Board
4.5	Unitary transformations	3	Chalk & Talk	Black Board
4.6	Symmetries and conservation laws-space inversion	3	Chalk & Talk	Black Board
UNIT -5 ANGULAR MOMENTUM				
5.1	The eigenvalue spectrum	3	Chalk & Talk	Black Board
5.2	Matrix representation of J in the jm basis	3	Chalk & Talk	Black Board
5.3	Spin angular momentum	3	Chalk & Talk	Black Board
5.4	Addition of angular momenta	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.5	Clebsch-Gordon coefficients: determination of $< j_1; j- j_1 \| jj>$	3	Chalk & Talk	Black Board

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

**** The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To analyze the inadequacy of Classical mechanics to explain black body radiation, photoelectric effect, specific heat of solids and Compton effect.	K2	PSO1, PSO2, PSO3
CO 2	To discuss the basic postulates of Quantum mechanics.	K2	PSO1, PSO2, PSO3
CO 3	To explain the general formalism of wave function and to write the Schrodinger's equation and obtain the Eigen values and Eigen functions of a particle in a square potential well; To discuss the problem of barrier penetration.	K3	PSO1, PSO2, PSO3, PSO5
CO 4	To solve the problem of Simple harmonic oscillator by Schrodinger's method and also by abstract operator method.	K2, K3	PSO1, PSO2, PSO3, PSO5
CO 5	a) To compare Schrodinger's notation with Dirac notation and to discuss the representation of state vectors and operators. b) To outline the matrix representation of orbital and spin angular momenta and to calculate Clebsch -Gordon coefficients.	K3 & K4	PSO1, PSO2, PSO3, PSO5

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	3	3	2	2
CO3	3	3	3	2	3
CO4	3	3	3	2	3
CO5	3	3	3	2	3

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	3	2	3	2
CO2	3	2	3	2
CO3	3	2	3	2
CO4	3	2	3	2
CO5	3	2	3	2

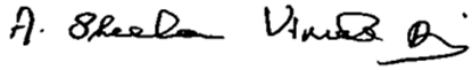
Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

COURSE DESIGNER:

1.Dr. MathaviManisekar

2.Dr. M.V.Leena Chandra

Forwarded By



Dr. A. Sheela Vimala Rani

HoD's Signature & Name

I M.Sc.PHYSICS

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PAPH	19PG2P9	ELECTROMAGNETIC THEORY	Theory	5	3

COURSE DESCRIPTION

The purpose of this course is to provide the methods to analyse and understand the static electric field, the static magnetic field, and electromagnetic wave propagation. The course provides a basic knowledge of fundamental principles behind Electromagnetic Theories and Phenomena.

COURSE OBJECTIVES

This course helps to recall the basis of Electric and Magnetic fields. This course will improve the elemental concepts and enhance the intellectual, experimental, analytical and Mathematical skills of the students in Electricity, Magnetism, and Optics.

UNIT I: THE STATIC ELECTRIC FIELD: (15 HRS)

The electric field of several point charges and the superposition of fields- charge distributions- the electric scalar potential – the electric scalar-potential as a line integral of electric field- electric potential of charge distribution and the principle of superposition of potentials.

CHARGED PARTICLES MOVING IN ELECTRIC FIELDS:

Moving charge in electric fields- inkjet printers- electrostatic precipitators- electrostatic printing- sand papers and carpets made electrostatically- electrostatic separators.

UNITII: THE STATIC ELECTRICFIELD IN DIELECTRICS: (15 HRS)

Introduction- homogeneity, linearity and isotropy- dielectrics and permittivity - electric field in a dielectric- the electric dipole and dipole moment-polarization- boundary conditions- capacitors with dielectrics- dielectric strength- energy in a capacitor and energy density.

Divergence of flux density-Maxwell's divergence equation from Gauss law- divergence theorem- divergence of D and P in a capacitor – Poisson's and Laplace's equations.

Divergence of J and continuity relations for current- current and field at a conductor insulator boundary- current and field at a conductor – conductor boundary- Laplace's equations for conduction media- lightning, grounding and atmospheric conductivity

UNITIII: STATIC MAGNETIC FIELDS OF STEADY CURRENTS (15 HRS)

Magnetic flux and magnetic flux density – Magnetic flux over a closed surface- a comparison of divergence and curl- The vector potential.

CONDUCTORS AND CHARGED PARTICLES MOVING IN A STATIC MAGNETIC FIELD:

Introduction – charged particles moving in a static magnetic field- magnetic mirrors and bottles- magnetic levitation- moving conductors in a static magnetic field- magnetic brake.

PHYSICS OF PLASMA:

Electrical neutrality in a plasma- particle orbits and drift motion in a plasma- magnetic mirrors – the hydromagnetic equations- the pinch effect- magnetic confinement systems for controlled thermonuclear fusion- plasma oscillations and wave motion.

UNIT IV:TIME CHANGING ELECTRIC&MAGNETIC FILEDS: (15 HRS)

Moving conductor in a magnetic field – General case of induction- Examples of induction- Displacement current- Maxwell's equations from Ampere's law- General field relations.

Maxwell's equations as generalization of circuit equations- Maxwell's equations in free space- Maxwell's equations in harmonically varying fields.

PROPOGATION OF ELECTRO MAGNETIC WAVES

Plane monochromatic waves in non -conducting media- Energy density and flux- Plane monochromatic waves in conducting media.

UNIT V: WAVE GUIDES AND TRASMISSION LINES (15 HRS)

Introduction- circuits, Lines and guides- a comparison- The hollow rectangular wave guide Coaxial transmission line- Two lines of charge- Two wire transmission line- Single wire transmission line - Heart dipole field

ANTENNAS AND RADIATIONS:

Retarded potentials- the short dipole antenna and its radiation resistance – pattern and radiation resistance of $\lambda/2$ and $3\lambda/2$ dipoles.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

New developments in electromagnetic theory - magnetic monopoles - unification of electromagnetism and gravitation.

REFERENCES:

1. J.D. Krauss (IVedition),*Electromagnetics*,International Edition, McGraw Hill, Inc.

Unit I: Ch 2: 2.6-2.9, 2.12, 3.1, 3.2, 3.4-3.9

Unit II: Ch 4: 4.1-4.11, 4.18-4.22, 5.13-5.15, 5.17, 5.18

Unit III: Ch 6: 6.5, 6.6, 6.18, 6.19, 7.1, 7.2, 7.6, 7.10, 7.12, 7.14

Unit IV: Ch 10: 10.3-10.5, 10.11, 10.12, 10.17, 11.4-11.6

Unit V: Ch 14: 14.1, 14.2, 14.4, 4.12-4.15, 4.17, 15.4-15.6

2. Reitz & others(III Edition),*Foundations of Electromagnetic theory*, New Delhi:Narosa Publishing House, New Delhi.

Unit III: Ch 14: 14.1-14.7

Unit IV:Ch 17: 17.1,17.3, 17.4

REFERENCE BOOKS:

1.B.K.Bhat(1986),*Fundamentals of electromagnetic theory*,New Delhi:C.B.S. Publishers

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 THE STATIC ELECTRIC FIELD:				
1.1	Introduction to electromagnetic theory	1	Lecture & Chalk & Talk	Black Board
1.2	The electric field of several point charges and the superposition of fields- charge distributions-	3	Lecture & Chalk & Talk	Black Board
1.3	The electric scalar potential – the electric scalar- potential as a line integral of electric field-	3	Chalk & Talk	Black Board & LCD
1.4	Electric potential of charge distribution	3	Chalk &Talk, Lecture	PPT & Blackboard
1.5	Principle of superposition of potentials.	1	Chalk &Talk, Lecture	PPT & Blackboard
1.6	Moving charge in electric fields- inkjet printers- electrostatic precipitators	2	Chalk & Talk	Black Board
1.7	Sand papers and carpets made electrostatically- electrostatic separators	2	Chalk & Talk	Black Board
UNIT -2 THE STATIC ELECTRICFIELD IN DIELECTRICS:				
2.1	Introduction- homogeneity, linearity and isotropy- dielectrics and permittivity -	2	Lecture	Black Board & LCD

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.2	Electric field in a dielectric- the electric dipole and dipole moment-polarization- boundary conditions	2	Chalk & Talk	Black Board
2.3	Capacitors with dielectrics- dielectric strength- energy in a capacitor and energy density.	2	Chalk & Talk	Black Board
2.4	Divergence of flux density- Maxwell's divergence equation from Gauss law-	2	Chalk & Talk	Black Board
2.5	Divergence of D and P in a capacitor – Poisson's and Laplace's equations.	2	Chalk & Talk	Black Board
2.6	Divergence of J and continuity relations for current- current and field at a conductor insulator boundary	2	Chalk & Talk	Black Board
2.7	Current and field at a conductor – conductor boundary-	1	Chalk & Talk	Black Board
2.8	Laplace's equations for conduction media- lightning, grounding and atmospheric conductivity	2	Chalk & Talk	Black Board
UNIT -3	**STATIC MAGNETIC FIELDS OF STEADY CURRENTS**			
3.1	Magnetic flux and magnetic flux density – Magnetic flux over a closed surface	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.2	A comparison of divergence and curl- The vector potential.	2	Chalk & Talk	Black Board
3.3	Introduction – charged particles moving in a static magnetic field- magnetic mirrors and bottles	2	Chalk & Talk	Black Board
3.4	Magnetic levitation- moving conductors in a static magnetic field- magnetic brake	3	Chalk & Talk	Black Board
3.5	Electrical neutrality in a plasma- particle orbits and drift motion in a plasma-	2	Chalk & Talk	Black Board & LCD
3.6	Magnetic mirrors – the hydromagnetic equations- the pinch effect-	2	Chalk & Talk	Black Board
3.7	Magnetic confinement systems for controlled thermonuclear fusion- plasma oscillations and wave motion	2	Chalk & Talk	Black Board
UNIT -4	**TIME CHANGING ELECTRIC&MAGNETIC FILEDS:**			
4.1	Moving conductor in a magnetic field – General case of induction- Examples of induction-	2	Chalk & Talk	Black Board
4.2	Maxwell's equations from Ampere's law- General field relations.	2	Chalk & Talk	Black Board
4.3	Maxwell's equations as generalization of circuit equations	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.4	Maxwell's equations in free space- Maxwell's equations in harmonically varying fields.	2	Chalk & Talk	Black Board
4.5	Plane monochromatic waves in non -conducting media	2	Chalk & Talk	Black Board
4.6	Energy density and flux-	1	Chalk & Talk	Black Board
4.7	Plane monochromatic waves in conducting media.	2	Chalk & Talk	Black Board
4.8	Energy density and flux- Plane monochromatic waves in conducting media.	2	Chalk & Talk	Black Board
UNIT - 5 WAVE GUIDES AND TRASMISSION LINES				
5.1	Introduction- circuits, Lines and guides- a comparison-	3	Chalk & Talk	Black Board
5.2	The hollow rectangular wave guide Coaxial transmission line	3	Chalk & Talk	Black Board
5.3	Two lines of charge- Two wire transmission line-	3	Chalk & Talk	Black Board
5.4	Single wire transmission line - Heart dipole field	2	Chalk & Talk	Black Board
5.5	Retarded potentials- the short dipole antenna and its radiation resistance	2	Chalk & Talk	Black Board
5.6	Pattern and radiation resistance of $\lambda/2$ and $3\lambda/2$ dipoles.	2	Chalk & Talk	Black Board

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA

Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

The best out of two will be taken into account

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Gain insight about the electric field and their charge distribution at various condition such as in static and moving fields	K1	PSO1& PSO2
CO 2	Cultivate knowledge in dealing with the static electric field in dielectric media and their elaborated parameter study.	K1, K2,	PSO1, PSO2, PSO4
CO 3	Develop thorough knowledge of static and moving magnetic fields of steady current and charged	K1 & K3	PSO2& PSO4

	particles.		
CO 4	Detailed understanding of time dependent electric and magnetic fields and their wave propagation properties.	K1, K2, K3 &	PSO1,PSO2& PSO4
CO 5	Acquire essential knowledge in circuitry in transmission lines and wave guides and a detailed study about antenna.	K2 & K4	PSO4 &PSO5

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	1	1
CO2	3	3	2	3	1
CO3	2	3	1	3	1
CO4	3	3	1	3	1
CO5	2	1	1	3	3

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	3	1	1	1
CO2	2	3	1	1
CO3	1	3	2	1
CO4	2	3	1	1
CO5	1	3	3	1

COURSE DESIGNER:

1. **Mrs. Alphonsa Fernando**
2. **Dr.Ancemma Joseph**

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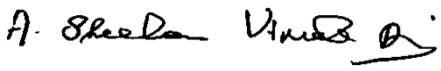

Dr. A. Sheela Vimala Rani **HoD's**

Signature & Name

I M.Sc. PHYSICS

SEMESTER –II

For those who joined in 2021 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	21PG2P10	INSTRUMENTATION AND MICROCONTROLLER	Theory	4	3

COURSE DESCRIPTION

This course introduces the physics of various transducers inclusive of resistive, inductive, capacitive, optical, digital and electrochemical transducers architecture of 8051 Microcontroller used in measurement systems.

COURSE OBJECTIVES

To enable the students to comprehend the working principle behind the various transducers and to make them assess and describe the basic properties and architecture of 8051 Microcontroller and to solve basic arithmetic operations and perform the necessary programming for it.

UNIT I: RESISTIVE TRANSDUCER (10 HRS)

Introduction-ElectricalTransducer-Selectinga transducer-Resistive Transducer- Potentiometer-Resistance Pressure Transducer- Resistive position Transducer-Strain Gauges-Semiconductor Strain Gauge-Resistance Thermometer-Thermistor

UNIT II:INDUCTIVE AND CAPACITIVE TRANSDUCER (12 HRS)

Inductive Transducer-Differential Output Transducers-Linear Variable Differential Transducer (LVDT)-Rotational Variable Differential Transducer (RVDT)-Pressure Inductive Transducer- Inductive Position Transducers (Synchro's)- Capacitive Transducer (Pressure), Load Cell (Pressure Cell)-Piezo Electrical Transducer

UNIT III : OPTICAL, MECHANICAL, DIGITAL AND ELECTROCHEMICAL TRANSDUCERS (14 HRS)

Photo Electric Transducer-Photo Multiplier Tube-Photo Cell-Photo Voltaic Cell-Semiconductor Photo Diode-The Photo-Transistor – Temperature Transducers-Resistance Temperature Detector (RTD) -Platinum Thin Film Sensors-ThermoCouple-Semiconductor Diode Temperature Sensor-Pyrometers- Frequency Generating Transducer-Mechanical Transducers-Digital Transducer- Electrochemical Sensing Elements-Electrochemical gas sensors-Hall effect sensors

UNIT IV: EMBEDDED INSTRUMENTATION-8051 MICROCONTROLLER (12 HRS)

Embedded Systems in Today's world- Need and advantages of using Microcontrollers in Instrumentation -Basics of microcontroller- Introduction to other microcontrollers viz. eZ80, PIC, AVR -8051 architecture:8051 microcontroller hardware-I/O pins, ports and circuits-External Memory-Counter and Timers-Serial data I/O Interrupts

UNIT V: 8051 PROGRAMMING (12 HRS)

8051 programming:Instruction syntax-moving data-logical operations-arithmetic operations- branching instructions-An 8051 Microcontroller design: Testing and Design

UNIT VI: DYNAMISM

Advancement in the new generation transducers in the current technology

Books for Study:

1. H S. Kalsi - Electronic instrumentation-McGraw Hill Education (2015)
2. John P Bentley - Principles of measurement systems-Pearson Prentice Hall (2005)
3. Kenneth.J. Ayala – The 8051 Microcontroller architecture, programming and applications – Penram International Publishing

Books for Reference:

1. Tattamangalam R. Padmanabhan - Industrial Instrumentation_ Principles and Design-Springer-Verlag London (2000)
2. K. Lal Kishore - Electronic Measurements & Instrumentation-Pearson Education (2012)
3. David A Bell - Electronic Instrumentation and Measurements-Prentice-Hall of India (2003)
4. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. McKinlay - The 8051 Microcontroller and Embedded Systems Using Assembly and C-Pearson (2006)
5. David Calcutt, Frederick Cowan, Hassan Parchizadeh - 8051 Microcontroller_ An Applications Based Introduction-Newnes (2004)

6. Tim Wilmshurst - Designing Embedded Systems with PIC Microcontrollers_ Principles and Applications-Newnes (2006)
7. Manish K Patel - The 8051 Microcontroller Based Embedded Systems-McGraw Hill Education (India) Private Limited (2014)

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 RESISTIVE TRANSDUCER				
1.1	Introduction-ElectricalTransducer-	2	Chalk & Talk	Black Board
1.2	Selectinga transducer-Resistive Transducer- Potentiometer-	2	Chalk & Talk	Black Board
1.3	Resistance Pressure Transducer-	1	Chalk & Talk	Black Board
1.4	Resistive position Transducer-	1	Chalk & Talk	Black Board
1.5	Strain Gauges-Semiconductor Strain Gauge-	2	Lecture	LCD
1.6	Resistance Thermometer-Thermistor	2	Chalk & Talk	Black Board
UNIT -2 INDUCTIVE AND CAPACITIVE TRANSDUCER				
2.1	Inductive Transducer-	3	Chalk & Talk	Black Board
2.2	Differential Output Transducers-Linear Variable Differential Transducer (LVDT)-	3	Chalk & Talk	Black Board
2.3	Rotational Variable Differential Transducer (RVDT)-	2	Lecture	LCD
2.4	Pressure Inductive Transducer-Inductive Position Transducers (Synchro's)-	1	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.5	Capacitive Transducer (Pressure), Load Cell (Pressure Cell)-	1	Lecture	LCD
2.6	Piezo Electrical Transducer	2	Lecture	LCD

UNIT -3 OPTICAL, MECHANICAL, DIGITAL AND ELECTROCHEMICAL TRANSDUCERS				
3.1	Photo Electric Transducer-Photo Multiplier Tube	2	Lecture	LCD
3.2	-Photo Cell-Photo Voltaic Cell-Semiconductor Photo Diode-The Photo-Transistor –	2	Chalk & Talk	Black Board
3.3	Temperature Transducers-Resistance Temperature Detector (RTD) - sensors-Hall effect sensors	1	Lecture	LCD
3.4	Platinum Thin Film Sensors-Thermo couple-	2	Lecture	LCD
3.5	Semiconductor Diode Temperature Sensor-Pyrometers-	1	Chalk & Talk	Black Board
3.6	Frequency Generating Transducer-	2	Lecture	LCD
3.7	Mechanical Transducers-Digital Transducer	2	Lecture	LCD
3.8	- Electrochemical Sensing Elements-Electrochemical gas	2	Lecture	LCD
UNIT -4 EMBEDDED INSTRUMENTATION – 8051 MICROCONTROLLER				
4.1	Embedded Systems in Today's world- Need and advantages of using Microcontrollers in Instrumentation	2	Lecture	Black Board
4.2	-Basics of microcontroller-Introduction to other microcontrollers viz. eZ80, PIC, AVR -8051 architecture:	2	Lecture	LCD

4.3	8051 microcontroller hardware-I/O pins, ports and circuits-	3	Chalk & Talk	Black Board
4.4	External Memory-Counter and Timers-	3	Lecture	LCD
4.5	Serial data I/O Interrupts activity	2	Chalk & Talk	Black Board
UNIT -5 8051 PROGRAMMING				
5.1	8051 programming	3	Chalk & Talk	Black Board
5.2	Instruction syntax-	3	Lecture	LCD
5.3	Moving data-logical operations-	2	Chalk & Talk	Black Board
5.4	Arithmetic operations-branching instructions-	2	Chalk & Talk	Black Board
5.5	An 8051 Microcontroller design: Testing and Design	2	Chalk & Talk	Black Board

Levels	**C1**	**C2**	**C3**	**C4**	**C5**	**Total Scholastic Marks**	**Non Scholastic Marks C6**	**CIA Total**	**% of Assessment**
	T1	**T2**	**Seminar**	**Assignment**	**OBT/PPT**				
	10 Mks.	**10 Mks.**	**5 Mks.**	**5 Mks**	**5 Mks**	**35 Mks.**	**5 Mks.**	**40Mks.**	
K2	**4**	**4**	**-**	**-**	**-**	**8**	-	**8**	20 %
K3	**2**	**2**	**-**	**5**	**-**	**9**	-	**9**	22.5 %
K4	**2**	**2**	**-**	**-**	**5**	**9**	-	**9**	22.5 %
K5	**2**	**2**	**5**	**-**	**-**	**9**	-	**9**	22.5 %
Non Scholastic	**-**	**-**	**-**	**-**	-		**5**	**5**	12.5 %
Total	**10**	**10**	**5**	**5**	**5**	**35**	**5**	**40**	**100 %**

CIA

Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**CIA**	**ESE**	**Total**
10	**10**	**5**	**5**	**5**	**5**	**40**	**60**	**100**

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

****The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To understand the basic knowledge on various resistive transducers	K1, K2	PSO1& PSO3
CO 2	To discuss the physics behind inductive and capacitive transducer	K2, K3	PSO2&PSO3
CO 3	To comprehend the working principle behind the various optical,mechanical , digital and electrochemical transducers.	K2 & K3	PSO1,PSO2&PSO3
CO 4	To assess and describe the basic properties and architecture of 8051 Microcontroller	K2, K3 & K4	PSO3 & PSO5
CO 5	To solve basic arithmetic operations and perform the necessary programming for it.	K1 , K2	PSO4 &PSO5

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**2**	**3**	**1**	**1**
CO2	**2**	**3**	**3**	**1**	**1**
CO3	**3**	**3**	**3**	**1**	**1**
CO4	**1**	**1**	**3**	**2**	**5**
CO5	**1**	**1**	**1**	**3**	**3**

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	3	1	1	1
CO2	2	3	1	1
CO3	1	3	2	1
CO4	1	3	3	1
CO5	1	3	3	1

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

Course Designer

1.Dr. M.V. Leena Chandra

2.Dr. Ancemma Joseph

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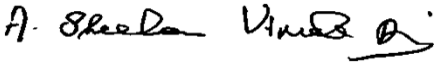

Dr. A. Sheela Vimala Rani

HoD's Signature & Name

I M.Sc. PHYSICS

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PAPH	19PG2P11	Non Electronics	Practical	4	2

COURSE DESCRIPTION

The course provides hands on training to work with counters, multivibrators and OP-AMP circuits, flip flops and microprocessor

COURSE OBJECTIVE/S

This course offers opportunity to handle the laboratory equipment's and develop lab skills in electronics experiments

LIST OF EXPERIMENTS

1) 3 bit Digital to Analog converter using IC 741 (Construct & Study its operation)
2) Multiplexer&Demultiplexer using IC74151, IC 74155 (Study the function of Multiplexer &Demultiplexer)
3) Analog to Digital converter (Construct & Study its operation)
4) Monostablemultivibrator using IC-555
5) Non Binary counter (Construction and verification of Truth tables) .
6) JK Master Slave Flip Flop (Construction and verification of Truth tables)
7) Sequence generator (To Implement a sequence generator using D-Flip-flop)
8) Astablemultivibrator using IC-741
9) Superconductivity using LC circuit.
10) MICROCONTROLLER-8051
    - Program to add two 8-bit data.
    - Program to multiply two 8-bit data.
    - Program to subtract 8 bit data from another 8 bit data.
    - Program to find the 1's complement of a binary number.
    - Program to find the 2'complement of a binary number.

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SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PAPH	19PG2P12	Electronics	Practical	4	2

COURSE DESCRIPTION

The course provides hands on training to work with Four Probe method, Prism, Grating and Quinke's method.

COURSE OBJECTIVE/S

This course offers opportunity to handle the laboratory equipment's and develop lab skills innon-electronics experiments

LIST OF EXPERIMENTS

1) Determination of the Resistivity of semiconductor by Four Probe method at different
temperatures.
2) Determination of susceptibility of the given liquid by Quinke's method.
3)Determination of Young's modulus and Poisson's ratio of the given glass plate by
employing hyperbolic fringes.
4) Copper Arc Spectrum- Determination of wavelength.
5).Study of absorption of LASER light on various filters
6.Determination of the refractive index of a transparent bar using diode laser.
7) Determination of mutual inductance of the given pair of coils for various angles by
Anderson's bridge.
8.Error analysis.
9.Determination of the numerical aperture of the given fiber
10.Characteristic study of Photo Detectors.
11.A.C. Bridges
12..Determination of Grating element using LASER

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HoD's Signature & Name

II M.Sc. Physics

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG3P13	CONDENSED MATTER PHYSICS	Theory	6	5

COURSE DESCRIPTION

The objective of this course is to understand the structure and propertiesof solid-state materials

COURSE OBJECTIVES

The course enables the student:

- To understand the structure of different types of crystals
- To study the types of binding of crystals
- To gain knowledge about lattice vibrations and properties like specific heat, thermal conductivity
- To discuss metallic and semiconductor crystals and their properties

UNIT I **(18 hrs)**

CRYSTAL STRUCTURE: Periodic arrays of atoms- lattice translational vectors- Basis and crystal structure- Primitive lattice cell. Fundamental types of lattices: Two dimensional and three dimensional lattice types. Index system for crystal planes – Simple crystal structures: Sodium chloride structure-Caesium chloride structure- Hexagonal close packed structure- Diamond structure-cubic zinc sulphide structure. Direct imaging of atomic structure- Non-ideal crystal structures. (self-study)

RECIPROCAL LATTICE:

Diffraction of waves by crystals: Bragg's law. Scattered wave amplitude: Fourier Analysis- Reciprocal lattice vectors –Diffraction condition – Laue Equations(self-study). Brillouin zones: Reciprocal lattice to sc, bcc andfcc. Fourier analysis of the basis: Structure factor of the bcc and fcc lattice-Atomic Form factor.

UNIT II (18 HRS)

CRYSTAL BINDING

Crystals of inert gases**:** Van der Waals-London Interaction – Repulsive Interaction – equilibrium Lattice Constants – Cohesive energy - Ionic crystals**:** Electrostatic or Madelung Energy – evaluation of Madelung constant. Covalent crystals - Metals- Hydrogen bonds**-** Atomic radii **–** Ionic Crystal radii.

UNIT III (18HRS)

PHONONS-CRYSTAL VIBRATIONS

Vibrations of crystals with monatomic basis**:** First Brillouin zone- group velocity- long wavelength limit.Two atoms per primitive basis - Quantization of elastic waves.

phonons-thermal properties

Phonon heat capacity**:** Planck Distribution- Normal mode enumeration- Density of states in 1D and 3D-Debye Model for density of states- Debye T^3 law- Einstein model of the density of states.

UNIT IV (18HRS)

FREE ELECTRON FERMI GAS

Energy levels in one dimension - Effect of temperature on the Fermi – Dirac distribution- Free electron gas in 3D.Heat capacity of the electron gas**:** Experimental heat capacity of metals.Electrical conductivity and ohm's law**:** Experimental electrical resistivity of metals (Umklapp scattering not included).Motion in magnetic fields: Hall effect. Thermal conductivity of metals: Wiedemann- Franz law.

energy bands :Nearly free electron model **- (**only descriptive – exclude origin and magnitude of energy gap) Bloch functions - Kronig - Penney model .

UNIT V **(18 hrs)**

SEMICONDUCTOR CRYSTALS:

Band gap- Equations of motion(exclude physical derivation) -Holes- Effective Mass- Intrinsic carrier concentration**:** Intrinsic mobility.

fermi surfaces and metals.

Reduced zone scheme, periodic zone scheme (explanation only) - Construction of Fermi surfaces(orbits not included).

Experimental methods in Fermi surface studies**:** Quantization of orbits in a magnetic field – De Haas-van Alphen effect.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Recent developed crystals in semiconductors, metals, ionic crystals –

study of any two crystals for each – their structure, properties and applications. (From published research papers).

BOOKS FOR STUDY:

Charles Kittel - Introduction to Solid State Physics - VIII Edition -

Unit 1: Ch -1, 2

Unit 2: Ch -3(page 48 to page 72 only)

Unit 3: Ch- 4 (page 91 to page 99 only) 5 (page 107 to page 118 only)

Unit 4: Ch- 6(exclude page 151), 7 (page 163 to page 169 only, (exclude 165,166)

Unit 5: Ch- 8(exclude pages 193, 199,200 to 205, 209 to 217).

Ch - 9 (page 223 to 228 only and pages 242 to 249only)

BOOKS FOR REFERENCE

1. Omar ,M.A. - Elementary Solid State Physics: Principles and applications- Addison Wesley- First Indian Reprint, 2000.

2. Srivastava ,J.P. - Elements of Solid State Physics –Prentice Hall of India Private Ltd. II Edition.
3. Pillai , S.O. -Solid State Physics- Revised and enlarged edition- Wiley Eastern Ltd. New Age International Ltd.

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 CRYSTAL STRUCTURE-RECIPROCAL LATTICE				
1.1	Periodic arrays of atoms- lattice translational vectors- Basis and crystal structure- Primitive lattice cell. Fundamental types of lattices : Two dimensional and three dimensional lattice types.	3	Lecture	LCD
1.2	Index system for crystal planes Simple crystal structures: Sodium chloride structure- Caesium chloride structure- Hexagonal close packed structure- Diamond structure- cubic zinc sulphide structure.	3	Lecture	LCD
1.3	Direct imaging of atomic structure- non-ideal crystal structures. (self-study)	2	Chalk & Talk	Black Board
1.4	Diffraction of waves by crystals: Bragg's law. Scattered wave amplitude: Fourier Analysis-	3	Chalk & Talk	Black Board
1.5	Reciprocal lattice vectors – Diffraction condition – Laue Equations(self-study). Brillouin zones: Reciprocallattice to sc, bcc andfcc. Fourier analysis of the basis: Structure factor of the bcc and fcc lattice-	3	Lecture	LCD
1.6	Fourier analysis of the basis: Structure factor of the bcc and fcc lattice	3	Chalk & Talk	Black Board
1.7	Atomic Form factor.	1	Lecture	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
				Board
UNIT -2 CRYSTAL BINDING				
2.1	Crystals of inert gases: Van der Waals-London Interaction – Repulsive Interaction – equilibrium Lattice Constants	6	Chalk & Talk	Black Board
2.2	Cohesive energy.Ionic crystals**:** Electrostatic or Madelung Energy – evaluation of Madelung constant.	6	Chalk & Talk	Black Board
2.3	Covalent crystals - Metals- Hydrogen bonds**-** Atomic radii **–** Ionic Crystal radii.	6	Chalk & Talk	Black Board
UNIT -3 PHONONS-CRYSTAL VIBRATIONS				
3.1	Vibrations of crystals with monatomic basis**:** First Brillouin zone- group velocity- long wavelength limit.Two atoms per primitive basis -	5	Lecture	OHP
3.2	Quantization of elastic waves.	2	Lecture	OHP
3.3	Phonon heat capacity**:** Planck Distribution- Normal mode enumeration-Density of states in 1D and 3D-Debye Model for density of states- Debye T^3 law-	6	Lecture	OHP
3.4	Einstein model of the density of states	5	Lecture	OHP
UNIT -4FREE ELECTRON FERMI GAS				
4.1	Energy levels in one dimension	1	Lecture	OHP
4.2	Effect of temperature on the Fermi –	2	Lecture	OHP
4.3	Dirac distribution- Free electron gas in 3D.Heat capacity of the electron gas**:** Experimental heat capacity of metals.	3	Lecture	OHP

4.4	Electrical conductivity and ohm's law**:** Experimental electrical resistivity of metals (Umklapp scattering not included).	2	Lecture	OHP
4.5	Motion in magnetic fields	1	Chalk & Talk	Black Board
4.6	Hall effect	2	Lecture	LCD
4.7	Thermal conductivity of metals: Wiedemann- Franz law.	2	Chalk & Talk	Black Board
4.8	Energy bands: Nearly free electron model	2	Chalk & Talk	Black Board
4.9	Bloch functions - Kronig - Penney model .	3	Lecture	OHP
UNIT -5 SEMICONDUCTOR CRYSTALS				
5.1	Band gap- Equations of motion	3	Chalk & Talk	Black Board
5.2	Effective Mass-	3	Lecture	OHP
5.3	Intrinsic carrier concentration **:**Intrinsic mobility	3	Chalk & Talk	Black Board
5.4	Fermi surfaces and metals Reduced zone scheme, periodic zone scheme	3	Chalk & Talk	Black Board
5.5	Quantization of orbits in a magnetic field – De Haas-van Alphen effect.	3	Chalk & Talk	Black Board
5.6	Experimental methods in Fermi surface studies De Haas-van Alphen effect.	3	Chalk & Talk	Black Board

Levels	**C1**	**C2**	**C3**	**C4**	**C5**	**Total Scholastic Marks**	**Non Scholastic Marks C6**	**CIA Total**	**% of Assessment**

	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/ PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	**4**	**4**	**-**	**-**	**-**	**8**	-	**8**	20 %
K3	**2**	**2**	**-**	**5**	**-**	**9**	-	**9**	22.5 %
K4	**2**	**2**	**-**	**-**	**5**	**9**	-	**9**	22.5 %
K5	**2**	**2**	**5**	**-**	**-**	**9**	-	**9**	22.5 %
Non Scholastic	**-**	**-**	**-**	**-**	-		**5**	**5**	12.5 %
Total	**10**	**10**	**5**	**5**	**5**	**35**	**5**	**40**	**100 %**

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					**NON - SCHOLASTIC**	**MARKS**		
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**CIA**	**ESE**	**Total**
10	**10**	**5**	**5**	**5**	**5**	**40**	**60**	**100**

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

The best out of two will be taken into account

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Explain Fourier analysis of crystals and compute the structure factor - Discuss the various types of crystal binding	K1, K2	PSO1, PSO2,PSO3
CO 2	Discuss quantization of elastic waves in lattice vibrations	K1,K2,K3	PSO3
CO 3	Analyze the thermal properties of solids by applying different models	K1,K2, K3	PS04,PSO5
CO 4	Discuss the Kronig-Penney model and its implications	K1, K2	PS04,PSO5
CO 5	Explain Fermi surfaces and determine the same by De Haas van Alphen effect	K1,K2,K3	PSO2, PSO4

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	1
CO2	2	2	3	1	1
CO3	3	1	2	1	3
CO4	2	1	2	3	3
CO5	2	3	1	3	2

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	3	2	3	2
CO2	3	3	2	3
CO3	3	2	3	2
CO4	1	3	3	3
CO5	3	2	2	2

Strongly Correlated – **3,**Moderately Correlated – **2,**Weakly Correlated -1

COURSE DESIGNER:

1. **Dr. L. Caroline Sugirtham**

Forwarded By

Dr. A. Sheela Vimala Rani

HoD's Signature & Name

II M.Sc.,PHYSICS

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG3P14	STATISTICAL MECHANICS	Theory	6	4

COURSE DESCRIPTION

This course develops concepts in Classical statistical mechanics, Quantum statistics, fluctuations and one dimensional random walk.

COURSE OBJECTIVES

The course provides a conceptually based exposure to some advanced topics in the field of equilibrium statistical physics. The course links thermodynamics to the micro description used in classical Statistical Mechanics. The course enables the students to understand the concepts of M-B, B-E and F-D statistics and to apply them to the real systems.

UNITS

UNIT –I INTRODUCTION (18 HRS)

Phase Space-Ensemble-Ensemble average-Liouville Theorem-Equation of motion-Equal-apriori-probability-Statistical equilibrium-Micro canonical ensemble-Entropy of an ideal Boltzmann gas using micro canonical ensemble-Gibb's paradox. Quantisation of phase space-basic postulates-classical limit-Symmetry of wave functions-effect of symmetry on counting-MB, BE and FD statistics-various distributions using micro canonical ensemble.

UNIT –II CANONICAL AND GRAND CANONICAL ENSEMBLES (18 HRS)

Entropy of a system in contact with a heat reservoir-Ideal gas in canonical ensemble-Maxwell velocity distribution-Equipartition of energy. Grand canonical ensemble-Ideal gas in grand canonical ensemble-Canonical partition function Translational partition function-Rotational partition function-Vibrational partition function-Electronic partition function.

UNIT –III BOSE-EINSTEIN STATISTICS (18 HRS)

Bose-Einstein distribution-Bose-Einstein condensation **Thermodynamic properties of an ideal BE gas**-Liquid Helium-Landau spectrum of Phonons and Protons Helium 4 and Helium 3 mixtures-Superfluid phases of Helium

UNIT –IV FERMI-DIRAC STATISTICS (18 HRS)

Fermi-Dirac distribution-degeneracy-Thermionic emission-white dwarfs-**Nuclear matter**-Quantum Hall effect.

UNIT –V FLUCTUATIONS (18 HRS)

Introduction-mean square deviation-Fluctuations in ensembles-Concentration fluctuations in quantum statistics-One dimensional random walk-Brownian motion-Fourier analysis of a random function-Electrical noise-Nyquist theorem.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

The Fractional Quantum Hall Effect

REFERENCES:

1. Agarwal.B.K. and Melvin Eisner, S***tatistical Mechanics***, New Age International Limited, New Delhi (2003) 2nd edition.
2. Donald A. McQuarrie, S***tatistical Mechanics*** Viva Books Private limited,(2003).
3. Silvio R A Salinas, I***ntroduction to Statistical Physics*** Springer,(2004)
4. Bhattacharjee, S***tatistical Mechanics*** Allied Publishers limited,(1996).
5. Kerson Huang, S***tatistical Mechanics*** Wiley Eastern(1988) third reprint

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3. https://www.cmi.ac.in/~kpnmurthy/StatisticalMechanics2017/book.pdf
4. https://www.britannica.com/science/degenerate-gas
5. https://www.space.com/23756-white-dwarf-stars.html
6. http://www.damtp.cam.ac.uk/user/tong/qhe.html
7. http://www.damtp.cam.ac.uk/user/tong/qhe/three.pdf)

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	UNIT -1 INTRODUCTION			

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.1	Indroduction	1	Chalk & Talk	PPT
1.2	Phase Space	1	Chalk & Talk	LCD
1.3	Ensemble-Ensemble average	2	Lecture	Black Board
1.4	Liouville Theorem-Equation of motion	2	Lecture	Black Board
1.5	Equal-apriori-probability-Statistical equilibrium	2	Lecture	Black Board
1.6	Micro canonical ensemble	2	Lecture	Black Board
1.7	Gibb's paradox.	2	Chalk & talk	Google classroom
1.8	Quantisation of phase space-basic postulates-classical limit	2	Lecture	Black Board
1.9	Effect of symmetry on counting-MB, BE and FD statistics-various distributions using micro canonical ensemble.	4	Lecture	Black Board
UNIT -2	**CANONICAL AND GRAND CANONICAL ENSEMBLES**			
2.1	Entropy of a system in contact with a heat reservoir	2	Lecture	Black Board
2.2	Ideal gas in canonical ensemble	2	Chalk & Talk	Black Board
2.3	Equipartition of energy. Grand canonical ensemble	4	Lecture	Black Board
2.4	Ideal gas in grand canonical	2	Lecture	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	ensemble			Board
2.5	Canonical partition function Translational partition function	2	Chalk & Talk	PPT
2.6	Rotational partition function-	2	Chalk & Talk	PPT
2.7	Vibrational partition function	2	Chalk & Talk	PPT
2.8	Electronic partition function.	2	Chalk & Talk	PPT
UNIT -3 BOSE-EINSTEIN STATISTICS				
3.1	Bose-Einstein distribution	3	Lecture	Black Board
3.2	Bose-Einstein condensation	4	Chalk & Talk	Black Board
3.3	Liquid Helium	2	Chalk & Talk	Black Board
3.4	Landau spectrum of Phonons and Protons	3	Chalk & Talk	PPT
3.5	Helium 4 and Helium 3 mixtures	3	Chalk & Talk	PPT
3.6	Super fluid phases of Helium 3.	3	Chalk & Talk	PPT
UNIT - 4 FERMI-DIRAC STATISTICS				
4.1	Fermi-Dirac distribution	4	Chalk & Talk	Black Board
4.2	degeneracy	4	Chalk & Talk	Black Board
4.3	Thermionic emission	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.4	white dwarfs	4	Chalk & Talk	PPT
4.5	Quantum Hall effect.	4	Chalk & Talk	PPT
	UNIT 5 FLUCTUATIONS			
5.1	Concentration fluctuations in quantum statistics	3	Chalk & Talk	PPT
5.2	One dimensional random walk	4	Chalk & Talk	PPT
5.3	Brownian motion	3	Chalk & Talk	PPT
5.4	Fourier analysis of a random function	4	Chalk & Talk	PPT
5.5	Electrical noise-Nyquist theorem.	4	Chalk & Talk	PPT

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks	Assignment 5 Mks	OBT/PPT 5Mks	35 Mks	5 Mks	40 Mks	
K2	4	4	-	-	-	8	-	8	20
K3	2	2	-	5	-	9	-	9	22.5
K4	2	2	-	-	5	9	-	9	22.5
K5	2	2	5	-	-	9	-	9	22.5

Non Scholastic	-	-	-	-	-		5	5	12.5
Total	10	10	5	5	5	35	5	40	100

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**CIA**	**ESE**	**Total**
10	**10**	**5**	**5**	**5**	**5**	**40**	**60**	**100**

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

**** The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

S. NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Analyse classical equilibrium thermodynamics to make physical predictions, describe the effects of quantum mechanics on statistical mechanics.	K3	PSO1, PSO2,PSO3
CO 2	Acquire knowledge onCanonical and Grand canonical ensembles.	K1	PSO1, PSO2,PSO3
CO 3	Understand the concepts of Bose Einstein condensation.	K2	PSO1, PSO2,PSO3
CO 4	Apply statistical mechanics to condensed matter systems such as Fermi gases, white dwarfs and nuclear matter.	K2,K3	PSO1, PSO2,PSO3
CO 5	Compute fluctuations in the systems of canonical, micro canonical and grand canonical ensembles and comprehend random process using Fourier analysis	K1,K2,K3	PSO1, PSO2,PSO3

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	3	3	2	2
CO3	3	3	3	2	2
CO4	3	3	3	2	2
CO5	3	3	3	2	2

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	3	2	3	2
CO2	3	2	3	2
CO3	3	2	3	2
CO4	3	2	3	2
CO5	3	2	3	2

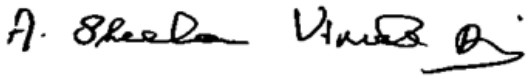
Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

COURSE DESIGNER:

1.Dr. M. V. Leena Chandra

2.Mrs. I. Jeya Sheela

Forwarded By



Dr. A. Sheela Vimala Rani

HoD's Signature & Name

II M.Sc. PHYSICS

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG3P15	NUCLEAR AND PARTICLE PHYSICS	Theory	6	5

COURSE DESCRIPTION

The aim of this course is to provide an overview of the fields of nuclear and particle physics.

COURSE OBJECTIVES

This course provides the knowledge about alpha and beta particles in nuclear physics. And it explains about nuclear fission and fusion reactions and its application in nuclear reactor. Expels knowledge in nuclear force and elementary particles.

UNIT –I ALPHA PARTICLES (18HRS)

Introduction- range of alpha particles-range-velocity-energy-life relations-alpha energy- -mass number- alpha particle spectra- Gamow's Theory of alpha decay, (decay probability, hindrance factors, spontaneous nuclear disintegration).

BETA-DECAY: Introduction- Beta-Spectroscopy. The neutrino hypothesis-energy- half life relationships-Fermi theory of Beta Decay, (Kurie plots, Mass of neutrino, Life time of beta decay, selection rules for allowed and forbidden transitions)-Parity violation- Helicity.

UNIT –II NUCLEAR FISSION (18 HRS)

The discovery of nuclear fission- fission cross sections and thresholds- the fission products-the mass and energy distributions of the fission products- Neutron emission in fission-the energy distribution of the neutrons emitted in fission-the energy release in fission- the theory of the fission process.

NUCLEAR ENERGY SOURCES:Nuclear fission as a source of energy- the chain-reacting system of nuclear reactor- Thermal nuclear reactors- The neutron cycle- the calculation of the multiplication factor for a homogeneous thermal reactor- the heterogeneous thermal reactor- power and breeding- energy production in stars- thermonuclear reactions-controlled thermo nuclear reactions.(self study)

UNIT –III NUCLEAR FORCE & MODELS (18 HRS)

NUCLEAR FORCES: The Deuteron- Ground State of the Deuteron- Triplet and Singlet states- Meson theory of Nuclear forces.

NUCLEAR MODELS: Introduction- Degenerate Fermi gas model- The Semi-empirical mass formula- the liquid drop model- the shell model- the collective model.

UNIT –IV NUCLEAR REACTIONS (18 HRS)

Types of nuclear reactions, conservation laws, Nuclear Reaction Kinematics- Solution to Q-equation; Nuclear cross- section, Partial wave analysis of Reaction cross-section, Requirements for a reaction- Reaction mechanism.

UNIT –V ELEMENTARY PARTICLES (18 HRS)

Introduction- Classification of Elementary particles- Particle Interactions (Gravitational, Electromagnetic, Strong, Weak) Conservation laws- Invariance under charge, parity, C.P, time reversal and C.P.T- Electrons and positrons- **protons and antiprotons- neutrons and antineutrons- neutrinos and Antineutrinos – Photons,** Mesons -Hyperons- Elementary particle symmetries, Quark theory.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Application of nuclear fission and nuclear fusion. Application of nuclear energy in constructive purposes.

REFERENCES

1. D.C. TAYAL "NuclearPhysics" UmeshPrakashan- Khurja
2. Irving Kaplan, Nuclear Physics, Addison-Wesley Publishing Company.
3. Arthur Beiser, Perspectives of Modern Physics, Mcgraw Hill Book company
4. SATHYA PRAKASH, Nuclear Physics and Particle Physics, Sultan Chand
5. Devanathan.V, Nuclear physics, Narosa publishers.
6. Harald Enge Addison, Introduction to Nuclear Physics, Wesley Publishing Company.
7. Radha Raman Roy, B. P. Nigam, Nuclear Physics: Theory and Experiment, John Wiley & Sons Ltd.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 ALPHA PARTICLES				
1.1	Introduction	1	Chalk & Talk	Black Board
1.2	Range of alpha particles, Range, Velocity and energy	2	Chalk & Talk	LCD
1.3	mass number	2	Lecture	PPT & White board
1.4	alpha particle spectra	2	Lecture	Smart Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.5	Gamow's Theory of alpha decay, (decay probability, hindrance factors, spontaneous nuclear disintegration)	2	Lecture	Black Board
1.6	Introduction to beta decay.	2	Discussion	Google classroom
1.7	Beta-Spectroscopy	2	Specimen	Microscope
1.8	The neutrino hypothesis, energy, half life relationships	2	Discussion	Black Board
1.9	Fermi theory of Beta Decay, Kurie plots, Mass of neutrino, Life time of beta decay,	1	Chalk & Talk	Black Board
	selection rules for allowed and forbidden transitions)-	1	Chalk & Talk	Black Board
1.10	Parity violation & Helicity	1	Discussion	Google class room
UNIT -2 NUCLEAR FISSION				
2.1	The discovery of nuclear fission	1	Lecture	PPT
2.2	Fission cross sections and thresholds	1	Chalk & Talk	Green Board
2.3	The fission products-the mass	1	Chalk & Talk	Black Board
2.4	Energy distributions of the and fission products	1	Chalk & Talk	Black Board
2.5	Neutron emission in fission	1	Chalk & Talk	Black Board
2.6	Energy distribution of the neutrons emitted in fission	2	Chalk & Talk	Black Board
2.7	Energy release in fission	1	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.8	The theory of the fission process.	1	Chalk & Talk	Black Board
2.9	Nuclear fission as a source of energy and chain-reacting system of nuclear reactor.	2	Discussion	Google class room
2.10	Thermal nuclear reactors	1	Chalk & Talk	Black Board
2.11	The neutron cycle, the calculation of the multiplication factor for a homogeneous thermal reactor	1	Chalk & Talk	Black Board
2.12	The heterogeneous thermal reactor & power and breeding	1	Chalk & Talk	Black Board
2.13	Energy production in stars	2	Chalk & Talk	Black Board
2.14	Thermonuclear reactions& controlled thermo nuclear reactions.	2	Chalk & Talk	Black Board
UNIT -3 NUCLEAR FORCES				
3.1	The Deuteron	1	Chalk & Talk	Black Board
3.2	Ground State of the Deuteron-	3	Chalk & Talk	Black Board
3.3	Triplet and Singlet states-	1	Chalk & Talk	Black Board
3.4	Meson theory of Nuclear forces.	1	Discussion	Google class room
3.5	Introduction to nuclear models	1	Discussion	Google class room
3.6	Degenerate Fermi gas model	3	Chalk & Talk	Black Board
3.7	The Semi- empirical mass formula	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.8	liquid drop model	1	Discussion	Google class room
3.9	Collective model.	3	Discussion	Google class room
3.10	The shell model	2	Chalk & Talk	Black Board
UNIT - 4 NUCLEAR REACTIONS				
4.1	Types of nuclear reactions	3	Chalk & Talk	Black Board
4.2	Conservation laws	2	Discussion	Google class room
4.3	Nuclear Reaction Kinematics	2	Chalk & Talk	Black Board
4.4	Solution to Q-equation	2	Chalk & Talk	Black Board
4.5	Nuclear cross- section,	3	Chalk & Talk	Black Board
4.6	Partial wave analysis of Reaction cross-section	3	Chalk & Talk	Black Board
4.7	Requirements for a reaction& Reaction mechanism.	3	Chalk & Talk	Black Board
UNIT -5 ELEMENTARY PARTICLES				
5.1	Introduction	1	Chalk & Talk	Black Board
5.2	Classification of Elementary particles	2	Chalk & Talk	Black Board
5.3	Particle Interactions (Gravitational, Electromagnetic, Strong, Weak)	2	Discussion	Google class room
5.4	Conservation laws-	2	Chalk &	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
			Talk	Board
5.5	Invariance under charge, parity time reversal and C.P.T	2	Chalk & Talk	Black Board
5.6	Electrons and positrons protons and antiprotons	2	Chalk & Talk	Black Board
5.7	neutrons ,antineutrons,neutrinos and Antineutrinos	2	Discussion	Google class room
5.8	Photons, Mesons & Hyperons	2	Discussion	Google class room
5.9	Elementary particle symmetries	2	Discussion	Google class room
5.10	Quark theory	1	Discussion	Google class room
UNIT -6 DYNAMISM				
6.1	Nuclear fission and fusion		Discussion	Google class room
6.2	Thermal nuclear reactors		Discussion	Google class room
6.3	Applications of nuclear energy for constructive purposes.		Discussion	Google class room

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1	T2	Seminar	Assignment	OBT/PPT				

	10 Mks.	10 Mks.	5 Mks.	5 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	**4**	**4**	**-**	**-**	**-**	**8**	-	**8**	20 %
K3	**2**	**2**	**-**	**5**	**-**	**9**	-	**9**	22.5 %
K4	**2**	**2**	**-**	**-**	**5**	**9**	-	**9**	22.5 %
K5	**2**	**2**	**5**	**-**	**-**	**9**	-	**9**	22.5 %
Non Scholastic	**-**	**-**	**-**	**-**	-		**5**	**5**	12.5 %
Total	**10**	**10**	**5**	**5**	**5**	**35**	**5**	**40**	**100 %**

CIA

Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**CIA**	**ESE**	**Total**
10	**10**	**5**	**5**	**5**	**5**	**40**	**60**	**100**

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks

C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

****The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To understand range of alpha particles, spectra and Gamow's theory of alpha decay. And to describe Fermi's theory of Beta decay.	K1	PSO1& PSO2
CO 2	To Describe nuclear energy sources	K1, K2,	PSO3
CO 3	Explain various nuclear models	K1 & K3	PSO5
CO 4	Describe nuclear reactions and solve some problems related to cross section	K1, K2, K3 &	PSO1, PSO2& PSO3
CO 5	Classify the elementary particles and explain their various properties	K2 & K4	PSO3& PSO4

Mapping of C0s with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**2**	**1**	**1**
CO2	**2**	**2**	**3**	**1**	**2**

CO3	**2**	**2**	**2**	**1**	**3**
CO4	**3**	**3**	**3**	**2**	**1**
CO5	**2**	**1**	**3**	**3**	**2**

Mapping of C0s with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	**3**	**1**	**1**	**1**
CO2	**3**	**2**	**1**	**1**
CO3	**1**	**3**	**2**	**1**
CO4	**1**	**2**	**3**	**1**
CO5	**3**	**2**	**1**	**1**

COURSE DESIGNER:

1. **Dr.A.Sheela Vimala Rani**

Forwarded By

Dr. A. Sheela Vimala Rani
HoD's Signature & Name

II M.Sc., PHYSICS

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	**19PG3P16**	**Practicals V GENERAL PHYSICS LAB**	**Practical**	**4**	**2**

COURSE DESCRIPTION

The lab course deals with **Advanced General Experiments** in Physics.

COURSE OBJECTIVE/S

The course gives a conceptual understanding of electrical, magnetic, optical and magneto-opticproperties of materials, propagation of Ultrasonic waves through liquids, lattice parameters of crystals, principle and efficiency of solar water heater, properties of polarized light.

LIST OF EXPERIMENTS

1. Hall Effect-Determination of hall voltage, carrier density and carrier mobility of the given Ge crystal.
2. Solar water heater-Evaluation of thermal performance of domestic solar water heater.
3. Diode Laser- Investigation of (i) transmission of polarized beam, (ii)Irradiance of divergent beam
4. Faraday effect-Determination of angle of rotation and to calculate theVerdette Constant.
5. Ultrasonic Interferometer-Determination of ultrasonic velocity through distilledwater and compressibility of water at different temperatures.
6. Thermistor characteristics-Determination of temperature coefficient of thermistor
7. Determination of Miller indices and lattice parameter of an unknown powder material by Xray diffraction.
8. Laser-Determination of thickness of wire.
9. Determination of dielectric constant of a liquid by RF oscillator method.

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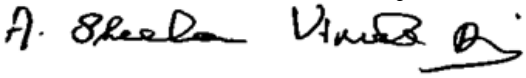

Dr. A. Sheela Vimala Rani
HoD's Signature & Name

II M.Sc., PHYSICS

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG3P17	Practicals VI ADVANCED ELECTRONICS	Practical	4	2

COURSE DESCRIPTION

This course gives an opportunity to understand the characteristics and applications of Electronic devises like Op- Amp, Photo diode, FET, UJT, SCR, Klystron, Micro controller and Transmission line.

COURSE OBJECTIVE/S

With the knowledge gained, the student should be in a position to use the various electronic devises mentioned here for various applications. Also the student is exposed to Mathematica –Wolfram language and Wolfram cloud to plot simple functions.

LIST OF EXPERIMENTS

1. Solving simultaneous linear equations-using OP-AMP
2. Transmission line- Determination of Input Impedance, Attenuation of line, Phase displacement of line.
3. SCR characteristics
4. UJT characteristics
5. UJT-Relaxation Oscillator
6. Microcontroller- Interfacing with electrical switches and LEDs.
7. FET characteristics
8. Photodiode characteristics.
9. Op-amp - Design of square wave, saw tooth wave, and Triangular wave generators.
10. Plotting simple functions using Mathematica
11. (i) Plot a polynomial (ii) Plot a quadratic function

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Dr. A. Sheela Vimala Rani
HoD's Signature & Name

II M.Sc. PHYSICS

SEMESTER –IV

***For those who joined in 2019 onwards* (*Bookman Old Style 1*)**

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG4P18	ADVANCED CONDENSED MATTER PHYSICS	Theory	6	5

COURSE DESCRIPTION

The objective of this course is to understand in depth the physics of the properties of metals, superconductors, dielectrics and magnetic solids

COURSE OBJECTIVES

The course enables the student:

- To understand the transmission and reflection properties of plasmons
- To study the types of lattice defects
- To gain knowledge about thesuperconducting property of solids
- To understand the polarisation and magnetisation properties of solids

UNITS

UNIT I (18HRS)

Plasmons, polaritons, polarons and excitons

Dielectric function of the electron gas**:** Dispersion relation for electromagnetic waves- Transverse optical modes in a plasma – transparency of alkali in the ultraviolet- longitudinal plasma oscillations. Plasmons - Electrostaticscreening**:** Mott-Metal transition- screening and phonons in metals. Polaritons**:** LST relation. Polarons- Excitons(types of excitons explanation only. No derivation).

UNIT II(18HRS)

Point defects - Lattice vacancies: Schottky defect, Frenkel defect- Diffusion: Metals- Colorcenters: F Centers, Other centers in alkali halides.

Super conductivity

Experimental survey: Occurrence of super conductivity-Destruction of superconductivity by magnetic fields – Meissner effect – Heat capacity – Energy gap – Microwave and infrared properties – Isotope effect.

Theoretical survey**:** Thermodynamics of the superconducting transition – London equation – Coherence length – BCS theory of superconductivity – BCS ground state.

UNIT III(18HRS)

Flux quantization in a superconducting ring – Type II superconductors – Vortex state – Estimation of H_{C1} and H_{C2}- Single particle tunneling – Josephson superconductor tunneling – DC Josephson effect – AC Josephson effect – Macroscopic quantum interference – High Temperature superconductors.

UNIT IV(18HRS)

Dielectrics and ferroelectrics - Macroscopic electric field**:** Depolarization field. Local electric field at an atom**:**Lorentz field. Dielectric constant and polarizability- electronic polarizability –classical theory of electronic polarizability. Structural phase transitions. Ferroelectric crystals **:**Classification of ferroelectric crystals. Displacive transitions**:** Soft Optical Phonons – Landau theory of the phase transition – second order transition – first transition – antiferroelectricity – ferroelectric domains – piezoelectricity.

UNIT V(18HRS)

Diamagnetism and paramagnetism - Langevin diamagnetism equation. Quantum theory of diamagnetism of mononuclear systems. Paramagnetism- Quantum theory of Para magnetism:Rare earth ions, Hund rules. Paramagnetic susceptibility of conduction electrons

Ferromagnetism and Antiferromagnetism- Ferromagnetic order:Curie point and the exchange integral **–** Magnons**:**Dispersion relation of magnons.

Ferrimagnetic order**:** Curie temperature and susceptibility of ferrimagnets. Antiferromagnetic order**:** susceptibility below Neel temperature. Ferromagneticdomains**:** Anisotropy energy, Transition region between domains

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Recent developed crystals in superconductors, dielectrics, ferroelectrics, Ferromagnetic, antiferromagnetic, ferrimagnets - study of any two crystals for each – their structure, properties and applications. Explain spintronics and their applications. (From published research papers).

BOOKS FOR STUDY:

1. Introduction to Solid State Physics VIII Edition – Charles Kittel-
   Unit 1: Ch-14 (page 394 to page 416 only and pages 420 to 421 only),
   Ch-15 (pages 435 to 441 only)
   Unit 2: Ch-10(page 259 to page 279 only), Ch-20.

Unit 3: Ch-10 (from page 279 to page 293 only)

Unit 4: Ch- 16

Unit 5: Ch-11 (page 299 to page 306 only and pages 315 to 317 only),

Ch - 12 (page 323 to page 325 only and pages 330 to 333, 336 to 338 excluding antiferromagnetic magnons, then include pages 340 to 343 only, 346 to 350 only)

BOOKS FOR REFERENCE

2. Omar, M.A.- ElementarySolid State Physics: Principles and applications- Addison Wesley- First Indian Reprint, 2000.
3. Srivastava, J.P. - Elements of Solid State Physics –Prentice Hall of India Private Ltd.
II Edition.
4. Pillai, S.O. - Solid State Physics- S.O.Pillai Revised and enlarged edition- Wiley Eastern Ltd. New Age International Ltd.

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 PLASMONS, POLARITONS, POLARONS AND EXCITONS				
1.1	Dielectric function of the electron gas**:**Dispersion relation for electromagnetic waves-	2	Lecture	OHP
1.2	Transverse optical modes in a plasma – transparency of alkali in the ultraviolet- longitudinal plasma oscillations. Plasmons -	3	Lecture	LCD
1.3	Electrostaticscreening**:** Mott-Metal transition- screening and phonons in metals	4	Chalk & Talk	Black Board
1.4	Polaritons **:**LST relation	3	Chalk & Talk	Black Board
1.5	Polarons-	2	Chalk & Talk	Black Board
1.6	Excitons(types of excitons explanation only.	4	Lecture	LCD

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -2 POINT DEFECTS AND SUPER CONDUCTIVITY				
2.1	Lattice vacancies: Schottky defect, Frenkel defect	4	Chalk & Talk	Black Board
2.2	Diffusion: Metals	2	Chalk & Talk	Black Board
2.3	Colorcenters: F Centers, Other centers in alkali halides.	2	Lecture	LCD
2.4	Experimental survey: Occurrence of super conductivity-Destruction of superconductivity by magnetic fields – Meissner effect– Heat capacity – Energy gap – Microwave and infrared properties – Isotope effect.	4	Chalk & Talk	Black Board
2.4	Theoretical survey**:** Thermodynamics of the superconducting transition – London equation – Coherence length – BCS theory of superconductivity – BCS ground state.	6	Chalk & Talk	Black Board
UNIT -3 SUPER CONDUCTIVITY				
3.1	Flux quantization in a superconducting ring – Type II superconductors – Vortex state – Estimation of H_{C1} and H_{C2}-		Lecture	OHP
3.2	Single particle tunneling – Josephson superconductor tunneling – DC Josephson effect – AC Josephson effect – Macroscopic quantum interference –	8	Lecture	OHP
3.3	High Temperature superconductors.	4	Lecture	OHP

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -4DIELECTRICS AND FERROELECTRICS				
4.1	Dielectrics and ferroelectrics - Macroscopic electric field**:** Depolarization field. Local electric field at an atom**:**Lorentz field	5	Lecture	OHP
4.2	Dielectric constant and polarizability- electronic polarizability –classical theory of electronic polarizability.	4	Lecture	OHP
4.3	Structural phase transitions. Ferroelectriccrystals Classification of ferroelectric crystals. Displacive transitions**:** Soft Optical Phonons – Landau theory of the phase transition – second order transition – first transition –	5	Lecture	OHP
4.4	Antiferroelectricity – ferroelectric domains – piezoelectricity.	4	Lecture	OHP
UNIT -5 DIAMAGNETISM AND PARAMAGNETISM				
5.1	Langevin diamagnetism equation. Quantum theory of diamagnetism of mononuclear systems.	4	Chalk & Talk	Black Board
5.2	Paramagnetism- Quantum theory of Para magnetism:	3	Chalk & Talk	Black Board
5.3	Rare earth ions, Hund rules. Paramagnetic susceptibility of conduction electrons	3	Chalk & Talk	Black Board
5.4	Ferromagnetism and Antiferromagnetism- Ferromagnetic order:Curie point and the exchange integral	4	Lecture	LCD
5.5	Magnons**:**Dispersion relation of magnons.	4	Chalk & Talk	Black Board

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA

Scholastic	35
Non Scholastic	5
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

****The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Analyse the dispersion of electromagnetic waves in a non-magnetic solid	K1 , K2	PSO1, PSO2
CO 2	Identify lattice vacancies and defects and explain the colorcenters in crystals Compare the behaviour of normal conductor and superconductor Explain superconductivity based on various models and	K1, K2, K3	PSO3, PSO4

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
	theories		
CO 3	Identify dielectric medium and analyze their polarization properties	K1, K2, K3	PSO1,PSO3
CO 4	Identify magnetic solids and their properties Apply quantum theory and analyze the magnetisation and susceptibility properties	K1 , K2	PSO2,PSO5
CO 5	Discuss the formation of plasmons, polaritons, polarons and excitons and their interactions with the solids	K1 , K2	PSO2

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**2**	**2**	**1**
CO2	**2**	**2**	**3**	**3**	**1**
CO3	**3**	**1**	**3**	**1**	**1**
CO4	**2**	**3**	**2**	**1**	**3**
CO5	**2**	**3**	**1**	**1**	**1**

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	3	2	3	2
CO2	3	3	2	3
CO3	3	2	3	2
CO4	1	3	3	3
CO5	3	2	2	2

Strongly Correlated – **3,**Moderately Correlated – **2,**Weakly Correlated -1

COURSE DESIGNER:

Dr. L. Caroline Sugirtham

Forwarded By

Dr. A. Sheela Vimala Rani
HoD's Signature & Name

II M.Sc. PHYSICS

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	**19PG4PI9**	**MOLECULAR SPECTROSCOPY**	**Theory**	**6**	**5**

COURSE DESCRIPTION

This course imparts a thorough knowledge of spectroscopic methods of the different regions of the electromagnetic spectrum and the techniques available for the understanding of molecular structure, nature of bonding, molecular symmetry and inter and intra molecular interactions. This would help them to analyse any substance from the informations obtained through various spectroscopic techniques.

COURSE OBJECTIVES

To enable the student to learn different types of molecular spectroscopy such as Microwave, Spin Resonance, Infra-Red, Raman, Electronic and Nuclear Magnetic Resonance spectroscopy.

UNITS

UNIT –I MICROWAVE SPECTROSCOPY: **(18 HRS)**

The Rotation of molecules- Rotational spectra- Diatomic molecules- Poly atomic molecules-**Techniques and Instrumentation (Self study)** - Chemical analysis by Microwave Spectroscopy

UNIT –II - INFRA-RED SPECTROSCOPY: (18 HRS)

The Vibrating Diatomic molecule- The diatomic vibrating rotator- The vibration- rotation spectrum of Carbon Monoxide- breakdown of the Born-Oppenheimer Approximation: the interaction of rotation and

vibrations-The vibrations of Polyatomic molecule- **Techniques and Instrumentation. (Self-study)**

UNIT –III RAMAN SPECROSCOPY: (18HRS)

Introduction- Pure rotational Raman Spectra- Vibrational Raman Spectra- Polarization of Light and the Raman Effect- **Structure Determination from Raman and Infra-red spectroscopy-Techniques and Instrumentation(Self study).**

UNIT –IV ELECTRONIC SPECTROSCOPY OF MOLECULES:(18 HRS)

The Born-Oppenheimer Approximation- Vibrational Coarse Structure: Progressions- Intensity of vibrational electronic Spectra: The Frank- Condon Principle- Dissociation Energy and Dissociation Products- Rotational fine structure of Electronic-vibration transitions- The Fortrat Diagram- Predissociation- **Diatomic Molecules: summary(Self study).**

UNIT –V SPIN RESONANCE SPECTROSCOPY: **(18HRS)**

The nature of spinning particles- Interaction between spin and magnetic field- Population energy levels- Larmor precession -Relaxation times

NUCLEAR MAGNETIC RESONANCE:

Magnetic properties of Nuclei- Resonance Condition- **NMR Instrumentation (Self study)** - Relaxation Process- Bloch Equation- Chemical Shift-Indirect Spin- spin interaction- Hindered rotation- NMR Imaging- **Interpretation of certain NMR spectra (Self study).**

UNIT –VI DYNAMISM (For CIA only)

Application of microwave spectroscopy – Application of NMR instrumentation in day-to-day life

REFERENCES:

1. ColinN. Banwell and Elaine M. McCash - Fundamentals of Molecular Spectroscopy (Fourth Edition)-Tata McGraw Hill -New Delhi.

Unit I - Chapters: 2.1-2.6, 7.1-7.1.5

Unit II - Chapters: 3.1-3.5,3.8.1,3.8.3.

Unit III - Chapters: 4.1- 4.6

Unit IV - Chapters: 6.1- 6.1.8

2. G. Aruldhas - Molecular Structure and Spectroscopy (Second edition) - Prentice Hall Private Ltd
Unit V - Chapters: 10.1-10.5,10.7- .9,10.17-10.19 -

Digital Open Educational Resources (DOER)

1. https://www.vedantu.com/physics/molecular-spectroscopy

2.https://www.jeol.co.jp/en/products/nmr/basics.html#:~:text=NMR%20is%20an%20abbreviation%20for,in%20a%20powerful%20magnetic%20field

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 MICROWAVE SPECTROSCOPY				
1.1	Spectroscopy – Introduction	1	Chalk & Talk	Black Board
1.2	Rotation of molecules & Rotational spectra	2	Chalk & Talk	LCD
1.3	Diatomic Molecules -Rigid diatomic molecules	2	Lecture	Black board
1.4	Intensities of spectral lines	1	Lecture	Black Board
1.5	Effect of isotopic substitution	1	Lecture	Black Board
1.6	The non-rigid rotator	1	Chalk & talk	Black Board
1.7	The spectrum of a non-rigid rotator	1	Chalk &talk	Black Board
1.8	Polyatomic Molecules- linear molecules	2	Lecture	Black Board
1.9	Symmetric & Asymmetric Molecules	2	Lecture	Black Board
1.10	Techniques & Instrumentation	1	Lecture	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	& Chemical analysis by Microwave spectroscopy			Board
1.11	Problem solving & Test	4	Lecture	Black Board
UNIT -2 INFRA RED SPECTROSCOPY				
2.1	The Vibrating Diatomic Molecule- The energy of a diatomic molecule	1	Lecture	Black Board
2.2	The simple Harmonic Oscillator	1	Chalk & Talk	Black Board
2.3	The Anharmonic Oscillator	1	Lecture	Black Board
2.4	The Diatomic vibrating rotator	2	Lecture	Black Board
2.5	The Vibration-Rotation Spectrum of Carbon Monoxide	2	Chalk & Talk	Black Board
2.6	Breakdown of the Born-Oppenheimer Approximation	2	Lecture	Black Board
2.7	The Vibrations Of Polyatomic Molecules	2	Discussion	LCD
2.8	Problems Solving & Test	4	Lecture	Black Board
2.9	Techniques & instrumentation	3	Seminar	Black Board
UNIT -3 RAMAN SPECTROSCOPY				
3.1	Quantum theory of Raman effect	1	Lecture	PPT
3.2	Classical theory of Raman Effect	2	Lecture	Black Board
3.3	Pure Rotational Raman Spectra- Linear Molecules	1	Lecture	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.4	Symmetric Top Molecules	1	Lecture	Black Board
3.5	Raman Activity of vibrations	2	Lecture	LCD
3.6	Rule of Mutual Exclusion & Overtone and combination vibrations	1	Lecture	Black Board
3.7	Vibrational Raman Spectra	1	Lecture	Black Board
3.8	Rotational Fine Structure	1	Lecture	Black Board
3.9	Polarization of light and Raman Effect	2	Lecture	Black Board
3.10	Structure Determination from Raman & IR spectroscopy	2	Lecture	Black Board
3.11	Techniques and Instrumentation	2	Lecture	PPT
3.12	Problem solving	2	Lecture	Black Board
UNIT -4 ELECTRONIC SPECTROSCOPY OF MOLECULES				
4.1	Electronic Spectra of Diatomic Molecules	2	Lecture	Black Board
4.2	The Born-Oppenheimer Approximation & Vibrational coarse structure	2	Lecture	Black Board
4.3	Franck-Condon Principle	2	Lecture	PPT
4.4	Dissociation energy and Dissociation products	3	Lecture	Black Board
4.5	Rotational Fine structure of Electronic-vibration Transitions	2	Lecture	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.6	The Fortrat Diagram	2	Lecture	Black Board
4.7	Predissociation & Diatomic molecules: Summary	2	Lecture	Black Board
4.8	Problem solving	3	Lecture	Black Board
UNIT -5 SPIN RESONANCE & NMR SPECTROSCOPY				
5.1	The nature of Spinning Particles	1	Lecture	Black Board
5.2	Interaction between Spin & a Magnetic field	2	Lecture	Black Board
5.3	Population of energy levels & Larmor Precession	1	Lecture	Black Board
5.4	Relaxation Times	1	Lecture	Black Board
5.5	NMR : Magnetic properties of nuclei & Resonance condition	1	Lecture	Black Board
5.6	NMR Instrumentation	1	Lecture	LCD
5.7	Relaxation Processes	1	Lecture	Black Board
5.8	Bloch Equations	2	Lecture	Black Board
5.9	Chemical shift	1	Lecture	Black Board
5.10	Indirect Spin –Spin interaction	2	Lecture	Black Board
5.11	Hindered rotation	1	Lecture	Black Board
5.12	NMR imaging	1	Lecture	PPT
5.13	Problem solving & Test	3	Lecture	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
				Board

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA	
Scholastic	35

Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**CIA**	**ESE**	**Total**
10	**10**	**5**	**5**	**5**	**5**	**40**	**60**	**100**

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

****The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Identify the various interactions of radiation with matter and the corresponding regions in the electromagnetic spectrum.	K1	PSO1, PSO2
CO 2	Derive the relationship between molecular spectra and molecular properties	K2, K3	PSO3, PSO4
CO 3	Explain Microwave, Spin Resonance, Infra Red, Raman, Electronic and NMR spectra and the associated techniques and instrumentation.	K1 & K3	PSO1,PSO3
CO 4	Apply the theory to understand molecular spectra	K2, K3& K4	PSO2,PSO5
CO 5	Derive Bloch equations	K2 & K4	PSO2

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**2**	**2**	**1**
CO2	**2**	**2**	**3**	**3**	**1**
CO3	**3**	**1**	**3**	**1**	**2**
CO4	**2**	**3**	**1**	**1**	**3**
CO5	**2**	**3**	**2**	**1**	**1**

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4

CO1	**3**	**2**	**1**	**1**
CO2	**1**	**3**	**2**	**2**
CO3	**1**	**1**	**3**	**2**
CO4	**3**	**2**	**1**	**3**
CO5	**2**	**3**	**1**	**3**

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. **Mrs. S.ArulmozhiPackiaseeli**
2. **Dr. R. Jothi Mani**

Forwarded By

Dr. A. Sheela Vimala Rani
HoD's Signature & Name

II M.Sc. PHYSICS

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG4P20	Advanced Quantum Mechanics	Theory	6	5

COURSE DESCRIPTION

This course deals with the approximation methods for stationary states, evolution of time concepts, scattering theory and relativistic quantum mechanics.

COURSE OBJECTIVES

- Gain knowledge of time independent perturbation theory and application of charge particle in a electromagnetic field
- Solve quantum mechanical problems using variation method and solve one dimension Schrödinger equation using WKB approximation method
- Insight of dipole approximation, harmonic perturbation, Fermi's Golden rule
- Derive Relativistic wave equations using Klien Gordan and Dirac formulations

UNITS

UNIT –I APPROXIMATION METHODS FOR STATIONARY STATES

(18 HRS)

Perturbation theory for discrete levels: Equations in various order of perturbation theory – The Non degenerate case-The first order - The second order – The degenerate case- Removal of degeneracy – **The effect of an electric field on the energy levels of an atom (Stark effect):** (a) The ground state of the hydrogen atom (b) The first excited level of the hydrogen atom

UNIT –II **(18 HRS)**

The variation method: Upper bound on ground state energy application to excited states- Trial function linear in variational parameters – **The hydrogen molecules.**

The WKB Approximation-The one-dimensional Schrödinger equation: a) the asymptotic solution b) solution near a turning point c) matching at a linear turning point d) Asymptotic connection formula-**The Bohr – Sommerfield Quantum condition.**

UNIT –III SCATTERINGTHEORY (18 HRS)

The scattering cross section : General considerations- Kinematics of the scattering process : Differential and total cross- section- wave mechanical picture of scattering : the scattering amplitude- Green's functions: formal expression for scattering amplitude- the Born approximation -validity of the Born- approximation – the Born series.

Partial wave Analysis – Asymptotic Behavior of Partial waves: Phase shifts: a) Partial waves b) Asymptotic form of radial function c) Phase shifts **– the scattering amplitude in terms of phase shifts** – the differential and total cross sections: optical theorem. .

UNIT –IV EVOLUTION WITH TIME (18 HRS)

Perturbation theory for time evolution problems: Perturbative solution for transition amplitude – Selection rules – First order transitions : Constant perturbation a) Transition probability b)closed spaced levels: constant transition rate- Harmonic perturbations a) amplitude for transition with change of energy b) Transitions induced by incoherent spectrum of perturbing frequencies – Interaction of an atom with electromagnetic radiation – The dipole approximation: selection rules – **the Einstein coefficient: Spontaneous Emission**

UNIT –V RELATIVISTIC WAVE EQUATIONS (18 HRS)

Generalization of the Schrodinger Equation: The Klein-Gordon equation: Plane wave solution; charge and current densities- Interaction with electromagnetic fields; Hydrogen like atom. The Dirac Equation: Dirac's

relativistic Hamiltonian- Position probability density: expectation values- Dirac matrices- Plane wave solutions of the Dirac equation : energy spectrum- The spin of the Dirac particle – Significance of negative energy states; **Dirac particle in Electromagnetic fields -Spin magnetic moment- The spin orbit energy.**

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Applications of quantum mechanics in the current field.

REFERENCES

1.P.M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics, Second Edition– Tata Mc Graw- Hill Publishing Company Limited New Delhi.

Chapters:5,6,9&10

Unit I : 5.1-5.4,

Unit II : 5.6-5.9, 5.11-5.13

Unit III : 6.1-6.6, 6.8-6.11(a)

Unit IV : 9.7, 9.12-9.15

Unit V : 10.1-10.10, 10.15(b),10.16

WEB REFERNCES :(OPTIONAL):

NPTEL online courses – Relevant videos for Quantum mechanics.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT - APPROXIMATION METHODS FOR STATIONARY STATES:				
1.1	Perturbation theory for discrete levels	1	Chalk & Talk	Black Board
1.2	Equations in various order of perturbation theory	2	Chalk & Talk	Black Board
1.3	The Nondegenerate case.-The first order - The second order	3	Chalk & Talk	Black Board
1.4	The degenerate case- Removal of degeneracy	3	Chalk & Talk	Black Board
1.5	The effect of an electric field on the energy levels of an atom **(Stark effect):**	1	Chalk & Talk	Black Board
1.6	The ground state of the hydrogen atom	4	Discussion	Google classroom
1.7	The first excited level of the hydrogen atom	4	Chalk & Talk	Black Board
UNIT -2 VARIATION METHOD				
2.1	**The variation method**: Upper bound on ground state energy application to excited states	3	Chalk & Talk	Black Board
2.2	Trial function linear in variational parameters	2	Chalk & Talk	Black Board
2.3	The hydrogen molecule	2	Chalk & Talk	Black Board
2.4	**The WKB Approximation**-The one-dimensional Schrödinger equation: a) the asymptotic solution	4	Chalk & Talk	Black Board
	solution near a turning point c) matching at a linear turning	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	point d) Asymptotic connection formula			
2.5	The Bohr – Sommerfeld Quantum condition.	4	Discussion	Google classroom
UNIT- 3 SCATTERINGTHEORY				
3.1	The scattering cross section: General considerations	1	Chalk & Talk	Black Board
3.2	Kinematics of the scattering process: Differential and total cross- section-	3	Chalk & Talk	Black Board
3.3	Wave mechanical picture of scattering: the scattering amplitude- Green's functions: formal expression for scattering amplitude	4	Chalk & Talk	Black Board
3.4	Born approximation -validity of the Born- approximation – the Born series.	2	Chalk & Talk	Black Board
3.5	Partial wave Analysis – Asymptotic Behavior of Partial waves	2	Discussion	Google classroom
3.6	Phase shifts: a) Partial waves b) Asymptotic form of radial function c) Phase shifts	3	Lecture	PPT
3.7	scattering amplitude in terms of phase shifts – the differential and total cross sections: optical theorem	3	Discussion	Google classroom
UNIT- 4 EVOLUTIONWITHTIME				
4.1	Perturbation theory for time evolution problems: Perturbative solution for transition amplitude	2	Chalk & Talk	Black Board
4.2	Selection rules – First order	1	Chalk &	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	transitions		Talk	Board
4.3	Constant perturbation a) Transition probability	2	Chalk & Talk	Black Board
4.4	b)Closed spaced levels:constant transition rate-	2	Discussion	Google classroom
4.5	Harmonic perturbations - amplitude for transition with change of energy	2	Chalk & Talk	Black Board
4.6	Transitions induced by incoherent spectrum of perturbing frequencies	2	Lecture	PPT
4.7	Interaction of an atom with electromagnetic radiation	2	Chalk & Talk	Black Board
4.8	The dipole approximation: selection rules	3	Discussion	Google classroom
4.9	The Einstein coefficients: Spontaneous Emission.	2	Chalk & Talk	Black Board
UNIT-5 RELATIVISTICWAVE EQUATIONS				
5.1	Generalization of the Schrodinger Equation	2	Chalk & Talk	Black Board
5.2	The Klein-Gordon equation	2	Chalk & Talk	Black Board
5.3	Plane wave solution; charge and current densities	2	Chalk & Talk	Black Board
5.4	Interaction with electromagnetic fields; Hydrogen like atom.	1	Chalk & Talk	Black Board
5.5	The Dirac Equation: Dirac's relativistic Hamiltonian	1	Chalk & Talk	Black Board
5.6	Position probability density: expectation values	1	Lecture	PPT
5.7	Dirac matrices- Plane wave	3	Lecture	PPT

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	solutions of the Dirac equation			
5.8	Energy spectrum- The spin of the Dirac particle – Significance of negative energy states;	2	Discussion	Google classroom
5.9	Dirac particle in Electro magnetic fields	2	Chalk & Talk	Black Board
5.10	Spin magnetic moment- The spin orbit energy.	2	Chalk & Talk	Black Board

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA

Scholastic	**35**

Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**C5**	**CIA**	**ESE**	**Total**
10	**10**	**5**	**5**	**5**	**5**	**40**	**60**	**100**

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

****The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Understand perturbation theory	K1	PSO1& PSO2
CO 2	Solve quantum mechanical problems using variation method and solve one dimension Schrödinger equation using WKB approximation method	K1, K2,	PSO2&PSO5
CO 3	Explain about dipole approximation, harmonic perturbation, Fermi's Golden rule	K1 & K3	PSO1, PSO2& PSO5
CO 4	Understand scattering theory and partial wave analysis techniques	K1, K2, K3 &	PSO1, PSO4 & PSO3
CO 5	Solve the problems using relativistic equations	K2 & K4	PSO3, PSO4 & PSO5

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**2**	**1**	**1**
CO2	**2**	**3**	**1**	**1**	**3**
CO3	**3**	**3**	**2**	**1**	**3**
CO4	**3**	**1**	**3**	**3**	**1**
CO5	**2**	**1**	**1**	**3**	**3**

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	**3**	**1**	**1**	**1**

CO2	**2**	**3**	**1**	**1**
CO3	**1**	**3**	**2**	**1**
CO4	**3**	**2**	**1**	**1**
CO5	**1**	**2**	**3**	**1**

COURSE DESIGNER:

1.Dr.A.Sheela Vimala Rani

2. Dr. Ancemma Joseph

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Dr. A. Sheela Vimala Rani
HoD's Signature & Name

II M.Sc. PHYSICS

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG4P21	Practicals VII ADVANCED GENERAL PHYSICS LAB	Practical	4	2

COURSE DESCRIPTION

The lab course provides hands on experience in **Advanced General Experiments** in Physics.

COURSE OBJECTIVE/S

The course deals with electric, magnetic, optic and electromagnetic behaviour of materials,propagation of Ultrasonic waves through liquids, microwave characteristics.

LIST OF EXPERIMENTS

1. Determination of curie temperature, energy loss, and to trace the hysteresis (B-H) loop of a ferromagnetic specimen.
2. Ultrasonic Interferometer-Determination of ultrasonic velocity through KCl solution and its compressibility at different concentrations.
3. Determination of Dielectric constants of solids and liquids using capacitance method.
4. Impedance measurementusing LCR meter.
5. Determination of particle size using laser.
6. Microwave characteristics of reflex klystron-Determination of its frequency.
7. Determination of wavelength of a laser source using diffraction grating.
8. To study the magneto-striction of a given material.
9. G.M. counter-Characteristics, inverse square law.

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II M.Sc.PHYSICS

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PAPH	19PG4P22	Practicals VIII PROGRAMMING IN C++	PRACTICAL	4	2

COURSE DESCRIPTION

The course deals withComputational Programming skills.

COURSE OBJECTIVE/S

The course familiarizes the students to apply numerical methods in modern scientific computing.

Computational Programming Lab (C++ and Scilab programmes)

1. Evaluating a root of non-linear equation by Newton-Raphson method using external function
2. Program to solve system of linear equations using simple Gaussian elimination method
3. Program for straight line fit using the method of least squares for a table of data points
4. Program for polynomial curve fitting
5. Program to integrate any function or tabulated data using trapezoidal rule
6. Program to integrate any function or tabulated data using Simpson's rule
7. Program to compute the solution of a first order differential equation of type y'=f(x,y) using the fourth order Runge-Kutta method
8. Program to compute the interpolation value at a specified point, given a set of data points using Lagrangian interpolation representation
9. Program to compute the interpolation value at a specified point, given a set of data points using Newton's interpolation representation
10. Ascending and descending order of numbers and characters
11. Matrix addition, subtraction and multiplication
12. Transpose of a matrix
13. Program to calculate and print the mean, variance and standard deviation of set of N numbers
14. Program to solve the quadratic equation

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I M.Sc / MA

SEMESTER –I / II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19P1EDC/ 19P2EDC	MODERN PHOTOGRAPHY	Theory & Practical	3	3

COURSE DESCRIPTION

This course will familiarize the students with the fundamental techniques necessary for the creative use of photography by introducing them to the basic usage of SLR camera and Adobe Photoshop post processing.

COURSE OBJECTIVES

This course focuses on core photographic concepts like the basic parts of camera, its important control parameters and composition techniques of photography. The students will be introduced to basic exposure parameters namely F-number – Aperture – shutter speed – lighting-contrast-exposure-illumination etc., The course will include hands-on demonstrations with the SLR camera as well as basic digital image editing techniques comprising of the post production work like editing images, using retouching tools and filters by Adobe Photoshop. On completion of this course, students will have the opportunity to personally experience the creative potential of photography and the languages linked to it.

UNITS

UNIT I: INTRODUCTION TO PHOTOGRAPHY (9 HRS)

Introduction to photography- Personal uses- Photography Process- Writing with light- Camera: Basic parts- Important controls- Types of camera: video camera and digital camera.

UNIT II: LENS (9 HRS)

Introduction - focal length - speed of the lens- Special lenses - wide angle lens-telephoto lens – close up lens- zoom lens - Introducing the technical knowledge of using a SLR camera.

UNIT III: FOCUSING ASPECTS (9 HRS)

F-number – Aperture – shutter speed – lighting-contrast-exposure-illumination and use of flash light- composition of photography - Develop the skill of capturing technically good images.

UNIT –IV: PRACTICING INDOOR SUBJECTS (9 HRS)

Practicing indoor subjects like Passport, Portrait, Article, Still life subjects and outdoor subjects like landscape and moving object photography.

UNIT V: MODERN TECHNIQUES (9HRS)

Use of "Photoshop"- Practicing post production work like editing images, using retouching tools and filters by Adobe Photoshop - Preparation of digital id cards – greeting cards –video making.

UNIT –VI DYNAMISM(For CIA only)

Training in Adobe Photoshop software- Uses of Photography.

TEXT BOOK:

1. S.Thiagarajan (2007, IV edition), *The New Practical Photography,* SultanChand & Sons

REFERENCE BOOKS:

2. David Kilpatrick (1984), *Basic Photography*, Hamlyn London.
3. Michael Freeman(2005), Mastering *Colour Digital Photography*, Lark Books.

Digital Open Educational Resources (DOER):

1. https://www.pixinfocus.com/modern-photography/#:~:text=Modern%20photography%20is%20a%20period,a%20tool%20to%20capture%20images.
2. https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwitzLmlzYT2AhUYnUsFHW3gAGcYABAAGgJzZg&ae=2&ohost=www.google.com&cid=CAESWuD2EF-qhzLTgqE5oCetg4ol7CwWzho9AFf_wLJUdxxaWYMOs8h6doc0Jmb4W9anrNU8ujmi4sTnLTFXoK1rBFXpGMAIddNVy9yD4jZHy1zh1JTGFsCqoHiDTQ&sig=AOD64_1auHwND-

kaxB8VJEJSw4Hi1extHg&q&adurl&ved=2ahUKEwiNx7KlzYT2AhUGSmwGHbKEB0AQ0Qx6BAgDEAE

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 Introduction to Photography				
1.1	Introduction tophotography	1	Lecture	Black Board
1.2	Personal uses	2	Lecture	Black Board
1.3	Writing with light	1	Lecture	Black Board & LCD
1.4	Photographic process	1	Lecture	Black Board & LCD
1.5	Camera: Basic parts	1	Lecture	Black Board & LCD
1.6	Important controls	1	Lecture	PPT & Blackboard
1.7	Types of camera	1	Lecture	PPT
1.8	Video camera and digital camera.	1	Lecture	Black Board & LCD
UNIT -2 LENS				
2.1	Introduction	1	Lecture	LCD
2.2	Focal length	1	Lecture	LCD

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.3	Speed of the lens	1	Lecture	LCD
2.4	Wide angle lens	1	Lecture	LCD
2.5	Special lenses	1	Lecture	LCD
2.6	Telephoto lens	1	Lecture	LCD
2.7	Close up lens& zoom lens	1	Lecture	LCD
2.8	Introducing the technical knowledge of using a SLR camera.	2	Lecture	LCD
UNIT - 3 Focusing Aspects				
3.1	F-number	1	Lecture	LCD
3.2	Aperture & shutter speed	1	Lecture	LCD
3.3	Lighting& contrast	1	Lecture	LCD
3.4	Exposure	1	Lecture	LCD
3.5	Illumination and use of flash light	2	Lecture	LCD
3.6	Composition of photography	2	Lecture	LCD
3.7	Develop the skill of capturing technically good images	1	Lecture	LCD
UNIT – 4 Practicing indoor subjects				
4.1	Introduction	1	Lecture	PPT
4.2	Practicing indoor subjects like Passport	3	Lecture	PPT
4.3	Portrait, Article&Still life	2	Lecture	PPT

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	subjects			
4.4	Outdoor subjects like landscape and moving object photography	3	Lecture	PPT
UNIT-5 Modern Techniques				
5.1	Uses of "Photoshop"	1	Lecture	PPT
5.2	Practicing post production work like editing images	1	Lecture	PPT
5.3	Retouching tools and filters by Adobe Photoshop	2	Lecture	PPT
5.4	Preparation of digital ID cards	1	Lecture	PPT
5.5	Greeting cards	2	Lecture	PPT
5.6	Video making	2	Lecture	PPT

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1	T2	Seminar	Assignment	OBT/ PPT				

	10 Mks.	10 Mks.	5 Mks.	5 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	**4**	**4**	**-**	**-**	**-**	**8**	-	**8**	20 %
K3	**2**	**2**	**-**	**5**	**-**	**9**	-	**9**	22.5 %
K4	**2**	**2**	**-**	**-**	**5**	**9**	-	**9**	22.5 %
K5	**2**	**2**	**5**	**-**	**-**	**9**	-	**9**	22.5 %
Non Scholastic	**-**	**-**	**-**	**-**	-		**5**	**5**	12.5 %
Total	**10**	**10**	**5**	**5**	**5**	**35**	**5**	**40**	**100 %**

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					**NON - SCHOLASTIC**	**MARKS**		
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**CIA**	**ESE**	**Total**
10	**10**	**5**	**5**	**5**	**5**	**40**	**60**	**100**

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

****The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

S. NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Understand the basic phenomena of photography	K1 & K3	PSO1& PSO2
CO 2	Comprehend the basic parts of camera, its important control parameters and composition techniques of photography	K1	PSO1& PSO2
CO 3	Handle SLR camera and apply various composition techniques and shoot professional photographs	K1, K2,	PSO1, PSO2, PSO4 &PSO5
CO 4	Understand the modern technique of photoshop and develop skills to manipulate, edit and enhance the real time photographs using photoshop.	K1 & K3	PSO1& PSO2 PSO4 &PSO5
CO 5	Prepare their own digital ids and	K1, K2, K3 &	PSO1& PSO2

S. NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
	greeting cards with photoshop.		PSO4 &PSO5

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	1	1
CO2	3	3	2	1	1
CO3	3	3	2	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3

Mapping of C0s with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	3	1	2	2
CO2	3	1	3	2
CO3	3	2	2	1
CO4	2	3	2	1
CO5	3	3	3	1

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

Dr.R.Jothi Mani

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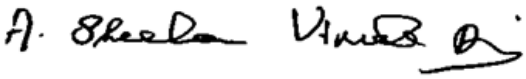

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II M.Sc.PHYSICS

SEMESTER –III

(*For those who joined in 2019 onwards*)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG3PE1A	Communication Systems	Theory	4	4

COURSE DESCRIPTION

This is a strong foundation course covering the principles of analog and digital communication systems involving different modulation and coding schemes. Also, it encompasses the fundamental concepts of satellite, fiberoptic communications and microwave generation**.**

COURSE OBJECTIVES

This course introduces the types of analog and digital modulation- AM, FM and PM, its various spectra,bandwidth requirements, Generation & detection and power relations. Further it also gives the basics of satellite communication laws and a description of source and detectors of fiber optic communication. Also, principles of basic, high frequency, microwave, wideband and special purpose antennas and microwave generation are dealt here.

UNITS

UNIT I : AMPLITUDE MODULATION (12HRS)

Introduction-Amplitude modulation- Amplitude modulation index-Modulation index for sinusoidal AM-Frequency spectrum for sinusoidal AM-Average power for sinusoidal AM - Effective voltage and current for sinusoidal AM – Double sideband suppressed carrier (DSBSC) modulation- Amplitude modulator circuits- Amplitude demodulator circuits. Single sideband principles- Balanced modulators- **SSB generation-SSB reception**- Modified **SSB systems- Signal to noise ratio for SSB- Companded SSB.(Selfstudy)**

UNIT II: ANGLE MODULATION (12HRS)

Introduction – Frequency modulation – Sinusoidal FM- Frequency spectrum for sinusoidal FM-Average power for sinusoidal FM- Modulation index for sinusoidal FM- Phase modulation- **Equivalence between PM and FM – Sinusoidal PM- Digital PM (Selfstudy)**- Angle modulator circuits- FM Transmitters- Angle modulation detectors.

UNIT III:PULSE AND DIGITAL MODULATION (12HRS)

Pulse amplitude modulation (PAM)- Pulse code modulation(PCM)- Pulse frequency modulation(PFM)- Pulse time modulation (PTM)- Pulse position modulation (PPM)-Pulse width modulation(PWM) Digital communication- Introduction- Synchronization -Asynchronous transmission- **Probability of Bit error in baseband transmission –Digital carrier systems**. **(selfstudy)**

UNIT IV:SATELLITE AND FIBER OPTIC COMMUNICATIOINS (12 HRS)

Kepler's first law- Kepler's second law- Orbits- Geostationary orbits- Power systems- Altitude control- Satellite station keeping- Antenna look angles- Limits of visibility- **Frequency plans and polarization-** Transponders –

Multiple access methods. (Selfstudy) FIBER OPTIC COMMUNICATIONS: Introduction-Light sources for fiber optics- Photodetectors- Connectors and Splices- Fiber optic communication link.

UNIT V:ANTENNAS AND MICROWAVE TUBES (12HRS)

Basic considerations – Wire radiators in space- Terms and definitions- **Effects of ground on antennas- antenna coupling at medium frequencies (Selfstudy)**- Directional high frequency antennas- Microwave antennas- Wideband and special - purpose antennas.Multicavity Klystron- Reflex Klystron- Magnetron- Travelling wave tube.

TEXT BOOKS:

1. Electronic Communication by Dennis Roddy &John Coolen (IV Edition)

UNIT I: Chapters (8.1- 8.11) & (9.1-9.8)

UNIT II: Chapter (10.1 –10.14)

UNIT III: Chapter (11.1-11.7) &(12.1 –12.4 &12.9)

UNIT IV: Chapters (19.1- 19.13 &19.18) & (20.5 – 20.8)

2. Electronic Communication systems by George Kennedy (IIIEdition)

UNIT V: Chapters (9.1- 9.9) & (11.1- 11.5)

REFERENCE BOOKS:

1. Communication systems by B.P.Lathi
2. Communication systems by Simon Haykin
3. Satellite communication by P.M.Gagliardi

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 AMPLITUDE MODULATION				
1.1	Amplitude modulation and index	1	Chalk & Talk	Black Board
1.2	AM-Frequency spectrum for sinusoidal AM-Average power for sinusoidal AM - Effective voltage	1	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	and current for sinusoidal AM			
1.3	Double sideband suppressed carrier (DSBSC) modulation	2	Chalk & Talk	Black Board
1.4	Amplitude modulator circuits- Amplitude demodulator circuits	2	Chalk & Talk	Black Board
1.5	Single sideband principles- Balanced modulators	2	Lecture	LCD
1.6	SSB generation-SSB reception- Modified SSB systems-	2	Chalk & Talk	Black Board
1.7	Signal to noise ratio for SSB- Companded SSB	2	Lecture	Black Board
UNIT -2 ANGLE MODULATION				
2.1	Introduction – Frequency modulation – Sinusoidal FM	2	Chalk & Talk	Black Board
2.2	Frequency spectrum for sinusoidal FM-Average power for sinusoidal FM-	2	Chalk & Talk	Black Board
2.3	Modulation index for sinusoidal FM- Phase modulation	2	Lecture	LCD
2.4	Equivalence between PM and FM	1	Chalk & Talk	Black Board
2.5	Sinusoidal PM- Digital PM	1	Lecture	LCD
2.6	Angle modulator circuits	2	Lecture	LCD
2.7	Angle modulation detectors	2	Lecture	LCD
UNIT -3 PULSE AND DIGITAL MODULATION				
3.1	Pulse amplitude modulation (PAM)- Pulse code modulation(PCM)	2	Lecture	LCD
3.2	Pulse frequency modulation(PFM)	2	Chalk & Talk	Black Board

3.3	Pulse time modulation (PTM	1	Lecture	LCD
3.4	Pulse position modulation (PPM)-Pulse width modulation (PWM)	1	Lecture	LCD
3.5	Digital communication	1	Chalk & Talk	Black Board
3.6	Introduction- Synchronization	1	Lecture	LCD
3.7	Asynchronous transmission	1	Lecture	LCD
3.8	Probability of Bit error in baseband transmission	1	Lecture	LCD
3.9	Digital carrier systems	2	Chalk & Talk	Black Board
UNIT -4 SATELLITE AND FIBER OPTIC COMMUNICATIOINS				
4.1	Kepler's first law- Kepler's second law- Orbits	1	Lecture	Black Board
4.2	Geostationary orbits- Power systems-	1	Lecture	LCD
4.3	Altitude control- Satellite station keeping	1	Chalk & Talk	Black Board
4.4	Antenna look angles- Limits of visibility	1	Lecture	LCD
4.5	Frequency plans and polarization	1	Chalk & Talk	Black Board
4.6	Transponders, Multiple access methods	1	Lecture	LCD
4.7	Fiber Optic Communications: Introduction-Light sources for fiber optics-	2	Chalk & Talk	Black Board
4.8	Photodetectors	1	Chalk & Talk	Black Board
4.9	Connectors and Splices	2	Lecture	LCD
4.10	Fiber optic communication link	1	Lecture	LCD
UNIT -5 ANTENNAS AND MICROWAVE TUBES				
5.1	Basic considerations – Wire radiators in space	1	Chalk & Talk	Black Board
5.2	Terms and definitions- Effects of ground on antennas	2	Lecture	LCD
5.3	antenna coupling at medium frequencies	1	Chalk & Talk	Black Board
5.4	Directional high frequency antennas- Microwave antennas	1	Chalk & Talk	Black Board

5.5	Wideband and special - purpose antennas.	2	Chalk & Talk	Black Board
5.6	Multicavity Klytstron- Reflex Klystron	2	Chalk & Talk	Black Board
5.7	Magnetron-	2	Lecture	LCD
5.8	Travelling wave tube.	1	Chalk & Talk	Black Board

	T1 **10 Mks.**	**T2** **10 Mks.**	**Seminar** **5 Mks.**	**Assignment** **5 Mks**	**OBT/PPT** **5 Mks**	**35 Mks.**	**5 Mks.**	**40Mks.**	
K2	**4**	**4**	**-**	**-**	**-**	**8**	-	**8**	20 %
K3	**2**	**2**	**-**	**5**	**-**	**9**	-	**9**	22.5 %
K4	**2**	**2**	**-**	**-**	**5**	**9**	-	**9**	22.5 %
K5	**2**	**2**	**5**	**-**	**-**	**9**	-	**9**	22.5 %
Non Scholastic	**-**	**-**	**-**	**-**	-		**5**	**5**	12.5 %
Total	**10**	**10**	**5**	**5**	**5**	**35**	**5**	**40**	**100 %**

CIA	
Scholastic	**35**

Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**CIA**	**ESE**	**Total**
10	**10**	**5**	**5**	**5**	**5**	**40**	**60**	**100**

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

****The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Explain amplitude modulation techniques and sideband principles	K1/K2/K3	PSO1& PSO2
CO 2	Describe the concepts of angle modulation and compare frequency and phase modulation	K1/K2/K3	PSO3
CO 3	Describe the key modules of Digital communication systems with emphasis on…PAM, Pulse code modulation (PCM), DM	K3/K4	PSO5
CO 4	Deduce the fundamental laws of of satellite communication and explain the principle of optical fiber communication	K1/K2/K3	PSO4
CO5	Describe about basic, high frequency, microwave, wideband and special purpose antennas and principles of microwave generation.	K1/K2/K3	PSO5

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**2**	**1**	**1**
CO2	**2**	**2**	**3**	**1**	**1**
CO3	**2**	**2**	**2**	**2**	**5**
CO4	**2**	**2**	**1**	**3**	**2**
CO5	**2**	**2**	**1**	**2**	**3**

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	3	1	2	2
CO2	3	1	3	2
CO3	3	2	2	1
CO4	2	3	2	1
CO5	3	3	3	1

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER

1. **Dr.Ancemma Joseph**
2. **Dr. Sr. Jenitta Rani**

Forwarded By

Dr. A. Sheela Vimala Rani
HoD's Signature & Name

II M.Sc.PHYSICS

SEMESTER –III

(*For those who joined in 2019 onwards*)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG3PE1B	Numerical Methods & Programming in C++	Theory	4	4

COURSE DESCRIPTION

This course provides object oriented techniques to write programs in C++ especially for numerical methods

COURSE OBJECTIVES

The objective of this course is to enable the students to learn the various numerical methods to solve algebraic & transcendental equations and also numerical differentiation and integration. Also it provides object oriented techniques to write programs in C++ especially for all the numerical methods.

UNITS

UNIT I: Numerical solutions of Algebraic and Transcendental Equation (12HRS)

Method of False position (Regula Falsi method)-Newton-Raphson Method-Solution of Simultaneous Linear Algebraic Equations: Gauss Elimination

Method-Interpolation with equal intervals: Gregory-Newton's forward interpolation formula for Equal Intervals- Gregory-Newton's Backward interpolation formula for Equal Intervals-Interpolation with unequal Intervals: **Lagrange's Interpolation Formula for unequal Intervals**

UNIT II: Numerical Differentiation and Integration (12 HRS)

Values of the derivatives of y, based on Newton's Forward Interpolation formula- Values of the derivatives of y, based on Newton's Backward Interpolation formula-Numerical integration: **Newton-Cote's Quadrature Formula- Trapezoidal rule**- Numerical solutions of ordinary differential equations: Euler's method- Runge-Kutta formulas of first and second order.

UNIT III: Object Oriented programming (12 HRS)

Introduction to OOP- Function Prototypes-Comments- Flexible Declarations-*structure, union* and *enum* Syntax- Typecasting-void Pointers- The :: Operator-References- **The const Qualifier**- Constructor for Intrinsic Data Types- The bool Data Type -Function Overloading –Operator overloading

UNIT IV :Classes in C++ (12 HRS)

Classes and Constructors- Destructors- A complex Class – **Overloaded operators Revisited**- *this* Pointer- Overloading Unary Operators- Postfix Notation- **Function Definition Outside the class**-new and delete Operators- *malloc*( )/*free*( ) versus new/delete-The Matrix Class-Classes, Objects and Memory

UNIT V :Inheritance and Polymorphism (12 HRS)

Inheritance-Constructors in multiple inheritance- Private inheritance-Protected inheritance- Functions that are not inherited- Pure virtual functions- Classes within classes- Friend functions.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Advanced features in friend functions, classes within classes, smart pointers.

BOOKS FOR STUDY:

1. **Veerarajan. T, Rmachandran T, Numerical Methods with programs in C and C++, Tata Mc Graw Hill Publishing company Ltd, New Delh**
   Unit I- Pages 3.5-3.5, 4.1-4.2, 6.1-6.4,7.6-7.7
   Unit II-Pages: 8.1-8.3,8.28-8.32, 10.16-10.18

2. **P. KanetkarYashavant, Let us C++, BPB publications, First Edition.**

Unit III Chapters: 1,2,3
Unit IV Chapter : 4
Unit V Chapters: 8,9,11(Relevant sections)

BOOKS FOR REFERENCE

1.Balagurusamy. E, Computer Oriented Numerical Methods, Prentice-Hall of India

2.Ravi Chandran. D, Programming with C++, Tata Mc Graw Hill Publishing company Ltd.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 NUMERICAL SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATION				
1.1	Method of False position(Regula Falsi method)-	1	Chalk & Talk	Black Board
1.2	Newton-Raphson Method-	1	Chalk & Talk	Black Board
1.3	Solution of Simultaneous Linear Algebraic Equations: Gauss Elimination Method	2	Chalk & Talk	Black Board
1.4	Interpolation with equal intervals: Gregory-Newton's	2	Chalk &	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	forward interpolation formula for Equal Intervals		Talk	Board
1.5	Gregory-Newton's Backward interpolation formula for Equal Intervals	2	Lecture	LCD
1.6	-Interpolation with unequal Intervals:	2	Chalk & Talk	Black Board
1.7	Lagrange's Interpolation Formula for unequal Intervals	2	Lecture	Black Board
UNIT -2 NUMERICAL DIFFERENTIATION ANDINTEGRATION				
2.1	Values of the derivatives of y, based on Newton's Forward Interpolation formula-	1	Chalk & Talk	Black Board
2.2	Values of the derivatives of y, based on Newton's Backward Interpolation formula-	2	Chalk & Talk	Black Board
2.3	Numerical integration	2	Lecture	LCD
2.4	Newton-Cote's Quadrature Formula	1	Chalk & Talk	Black Board
2.5	Trapezoidal rule	1	Lecture	LCD
2.6	Numerical solutions of ordinary differential equations:	2	Lecture	LCD
2.7	Euler's method- Runge-Kutta formulas of first and second order.	3	Chalk & Talk	Black Board

UNIT -3 OBJECT ORIENTED PROGRAMMING				
3.1	Introduction to OOP	2	Lecture	LCD
3.2	Function Prototypes	1	Chalk & Talk	Black Board

3.3	Comments- Flexible Declarations-*structure, union* and *enum* Syntax	1	Lecture	LCD
3.4	Typecasting-void Pointers	1	Lecture	LCD
3.5	The :: Operator-References	1	Chalk & Talk	Black Board
3.6	Constructor for Intrinsic Data Types	1	Lecture	LCD
3.7	The bool Data Type	1	Lecture	LCD
3.8	Function Overloading	2	Lecture	LCD
3.9	Operator overloading	2	Chalk & Talk	Black Board
UNIT -4 CLASSES IN C++				
4.1	Classes and Constructors	2	Lecture	Black Board
4.2	Destructors	1	Lecture	LCD
4.3	A complex Class	1	Chalk & Talk	Black Board
4.4	*This* Pointer	1		
4.5	Overloading Unary Operators -	1	Chalk & Talk	Black Board
4.6	Postfix Notation	1	Lecture	LCD
4.7	New and delete Operators	1	Chalk & Talk	Black Board
4.8	*Malloc*( )/*free*( ) versus new/delete	1	Chalk & Talk	Black Board
4.9	The Matrix Class	2	Lecture	LCD
4.10	Classes, Objects and Memory	1	Lecture	LCD
UNIT -5 INHERITANCE AND POLYMORPHISM				
5.1	Inheritance	1	Chalk & Talk	Black Board
5.2	Constructors in multiple inheritance	2	Lecture	LCD
5.3	Private inheritance	1	Chalk & Talk	Black Board
5.4	Protected inheritance	1	Chalk & Talk	Black Board
5.5	Functions that are not inherited	2	Chalk & Talk	Black Board
5.6	Pure virtual functions-	2	Chalk & Talk	Black Board

5.7	Classes within classes	2	Lecture	LCD
5.8	Friend functions	1	Chalk & Talk	Black Board

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	4	4	-	-	-	8	-	8	20 %
K3	2	2	-	5	-	9	-	9	22.5 %
K4	2	2	-	-	5	9	-	9	22.5 %
K5	2	2	5	-	-	9	-	9	22.5 %
Non Scholastic	-	-	-	-	-		5	5	12.5 %
Total	10	10	5	5	5	35	5	40	100 %

CIA

Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC	NON - SCHOLASTIC	MARKS

SCHOLASTIC					NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	C6	CIA	ESE	Total
10	10	5	5	5	5	40	60	100

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	solve Algebraic and Transcendental equations numerically using Regula Falsi and Newton Raphson method	K1,K2	PSO1& PSO2
CO 2	apply newton's forward and backward interpolation formulae to equal and unequal intervals	K2	PSO3
CO 3	evaluate numerical differentiation and integration	K1 , K2	PSO5
CO 4	compose C++ program using structures and classes and apply inheritance and polymorphism features in C++ programming.	K2 , K3	PSO4
CO5	Describe the design concepts of counters and shift registers.Demonstrate the various techniques to develop A/D and D/A converters	K2,K3	PSO5

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	1	1
CO2	2	2	3	1	1
CO3	2	2	2	3	3
CO4	2	1	2	3	3
CO5	2	1	3	2	3

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	3	1	1	1
CO2	2	3	1	2
CO3	1	3	2	1
CO4	2	3	1	1
CO5	1	3	3	1

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2** ♦ Weakly Correlated -**1**

COURSE DESIGNER:

1.Dr.Ancemma Joseph

2. Dr. M. Ragam

Forwarded By

Dr. A. Sheela Vimala Rani
HoD's Signature & Name

II M.Sc. PHYSICS

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG4PE2A	MATERIALS SCIENCE	Theory	4	4

COURSE DESCRIPTION

Materials science occupies the centre of the innovative research area. This course deals with the various crystal growth techniques, characterization methods, thin films, nano materials and other types of materials such as polymers and ceramics and glass.

COURSE OBJECTIVES

The course enables the student to study various crystal growth techniques and understand the characterizations techniques like TEM, SEM, TGA, XRD.

Also to analyse the mechanisms of Ceramics, Polymers and composites and discuss and explain various preparatory and measurements of thin film and distinguish carbon nanotubes & carbon nanomaterials and their preparatory techniques.

UNIT –I CRYSTAL GROWTH TECHNIQUES (12 HRS.)

Aqueous solution growth-nucleation-heterogeneous nucleation- crystal growth from melt-Bridgeman technique- Czochralski technique-zone melting technique-**liquid phase epitaxy(self study)**.

UNIT –II CERAMICS, POLYMERS AND COMPOSITES (12 HRS)

Ceramics- Classification of ceramics-general properties of ceramics-general properties and applications of selected engineering ceramics.

Polymers-Types of polymer-polymerization-thermosets-additives-structure of polymers-mechanism of molecular movement in polymers-**general properties andapplications of thermo plastics(self study)**

UNIT –III THIN FILMS (12 HRS)

Preparation of thin films- Thermal evaporation-**flash evaporation(self study)**- electron gun beam method-cathodic sputtering –chemical vapour deposition.Thickness measurements-Ellipsometry –interferometry-multiple beam interferometer-Fizeau technique-fringes of equal chromatic order (FECO) method.

UNIT –IV NANO POWDERS AND NANO MATERIALS (12 HRS)

What are nano materials? – preparation-plasma arcing-chemical vapour deposition -Sol-gels – electrodeposition – ball milling – using natural nanoparticles-**applications of nanomaterials**.

The Carbon age

New forms of carbon – types of nanotubes- formation of nanotubes

assemblies-purification of carbon nanotubes – the properties of carbon nano tubes - **uses ofnanotubes (self study)**

UNIT –V CHARACTERIZATION METHODS (12HRS)

Diffraction analysis- X-Ray diffraction-interpretation of diffraction pattern-cell parameter determination.

Thermal analysis- Thermo gravimetric analysis-**differential thermal analysis**-**differential scanning calorimetry(self study)**.

Electron microscopy-TEM, SEM –mode of operation-instrumental details-elemental analysis.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Sensors, solar cell, opto electronic devices

REFERENCES:

Unit I&V (Relevant sections)

1. Crystal growth processes and methods, by P.Santhana Raghavan,

   P. Ramasamy.

2. Antony R.West,Solid state chemistry and its applications

3. V.Raghavan, Materials science and engineering-A first course.

4. C.RichardBrundle, Charles A.Evans and Shaun Wilson

Encyclopidia of materials characterization

Unit II-William.D. Callister, Jr. Materials science and Engineering – an introduction (V edition)

Unit III- A.Goswami, Thin Film fundamentals by (New age International (P) Ltd.)

Unit IV- Mick Wilson, K.K.G.Smith, M.Simmons, &B.Raguse, Nanotechnology by (Overseas Press)

WEB REFERNCES :

https://www.elsevier.com/physical-sciences-and-engineering/materials-science

https://www.sciencedirect.com/referencework/9780128035818/materials-science-and-materials-engineering

http://www.istl.org/02-spring/internet.html

http://igorivanov.tripod.com/physics/materials.html

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 CRYSTAL GROWTH TECHNIQUES				
1.1	Aqueous solution growth-nucleation	1	Chalk & Talk	Black Board
1.2	heterogeneous nucleation	1	Chalk & Talk	LCD
1.3	crystal growth from melt	4	Lecture	PPT & White board
1.4	Bridgeman technique-	1	Lecture	Smart Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.5	Czochralski technique	1	Lecture	Black Board
1.6	zone melting technique	1	Discussion	Google classroom
1.7	chemical vapour technique-	2	Lecture	Black board
1.8	liquid phase epitaxy	1	Discussion	Black Board
UNIT -2 CERAMICS, POLYMERS AND COMPOSITES				
2.1	Ceramics- Classification of ceramics-general properties of ceramics	1	Chalk & Talk	Black Board
2.2	General properties and applications of selected engineering ceramics.	1	Chalk & Talk	LCD
2.3	Polymers-Types of polymer-polymerization	4	Lecture	PPT & White board
2.4	crystallinity-thermosets	1	Lecture	Smart Board
2.5	additives	1	Lecture	Black Board
2.6	general properties and applications of thermosetting plastics Subtopics	1	Discussion	Google classroom
2.7	structure of polymers-mechanism of molecular movement in polymers	2	Lecture	Black Board
2.8	elastomers	1	Discussion	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
				Board
UNIT -3 THIN FILMS				
3.1	Preparation of thin films- Thermal evaporation	1	Chalk & Talk	Black Board
3.2	electron gun beam method	1	Chalk & Talk	LCD
3.3	cathodic sputtering	4	Lecture	PPT & White board
3.4	chemical vapour deposition	1	Lecture	Smart Board
3.5	Thickness measurements- Ellipsometry	1	Lecture	Black Board
3.6	Interferometry	1	Discussion	Google classroom
3.7	multiple beam interferometer	2	Lecture	PPT & Whiteboard
3.8	Fizeau technique-fringes of equal chromatic order (FECO) method.	1	Discussion	Black Board
UNIT -4 NANO POWDERS AND NANO MATERIALS				
4.1	What are nano materials? preparation-plasma arcing – the properties of carbon nano tubes	1	Chalk & Talk	Black Board
4.2	chemical vapour deposition -	1	Chalk & Talk	LCD

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.3	Sol-gels	4	Lecture	PPT & White board
4.4	electrodeposition – ball milling	1	Lecture	Smart Board
4.5	New forms of carbon – types of nanotubes- formation of nanotubes	1	Lecture	Black Board
4.6	assemblies-purification of carbon nanotubes	1	Discussion	Google classroom
4.7	structure of polymers-mechanism of molecular movement in polymers	2	Lecture	PPT& Whiteboard
4.8	Elastomers	1	Discussion	Black Board
UNIT -5 CHARACTERIZATION METHODS				
5.1	Diffraction analysis- X-Ray diffraction	1	Chalk & Talk	Black Board
5.2	Electron and neutron diffraction	1	Chalk & Talk	LCD
5.3	Interpretation of diffraction pattern-cell parameter determination.	4	Lecture	PPT & White board
5.4	Thermal analysis- Thermo gravimetric analysis	1	Lecture	Smart Board
5.5	Differential thermal analysis-differential scanning calorimetry	1	Lecture	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.6	Electron microscopy	1	Discussion	Google classroom
5.7	TEM–mode of operation-instrumental details-elemental analysis.	2	Lecture	PPT& Whiteboard
5.8	SEM–mode of operation-instrumental details-elemental analysis.	1	Discussion	Black Board

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assessment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks.	Assignment 5 Mks	OBT/ PPT 5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	**4**	**4**	**-**	**-**	**-**	**8**	-	**8**	20 %
K3	**2**	**2**	**-**	**5**	**-**	**9**	-	**9**	22.5 %
K4	**2**	**2**	**-**	**-**	**5**	**9**	-	**9**	22.5 %
K5	**2**	**2**	**5**	**-**	**-**	**9**	-	**9**	22.5 %
Non Scholastic	**-**	**-**	**-**	**-**	-		**5**	**5**	12.5 %

Total	**10**	**10**	**5**	**5**	**5**	**35**	**5**	**40**	**100 %**

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					**NON - SCHOLASTIC**	**MARKS**		
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**CIA**	**ESE**	**Total**
10	**10**	**5**	**5**	**5**	**5**	**40**	**60**	**100**

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

****The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Deduce the expressions of Nucleation phenomena and explain various Crystal growth techniques	K1	PSO1& PSO2
CO 2	Explain the mechanism of molecular movements in Ceramics, Polymers and Composites	K1, K2,	PSO3
CO 3	Analyse various methods of preparing thin films and its measurement techniches	K1 & K3	PSO5
CO 4	Explore novel methods of preparing carbon nanomaterials and carbon nanotubes.	K1, K2, K3	PSO4
CO 5	understand the concepts of Diffraction analysis, Thermal analysis and Electron microscopy used in crystal characterisation	K2 & K4	PSO3 & PSO4

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**2**	**1**	**2**
CO2	**1**	**2**	**3**	**2**	**1**

CO3	**1**	**2**	**1**	**1**	**3**
CO4	**2**	**1**	**2**	**3**	**1**
CO5	**1**	**1**	**3**	**3**	**2**

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	**1**	**2**	**1**	**2**
CO2	**1**	**1**	**2**	**2**
CO3	**2**	**1**	**2**	**1**
CO4	**1**	**2**	**1**	**2**
CO5	**1**	**1**	**2**	**2**

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

3. **M.V.Leena Chandra**
4. **I. Jeya Sheela**

Forwarded By

Dr. A. Sheela Vimala Rani

HoD's Signature & Name

II M.Sc.PHYSICS

SEMESTER –IV

(*For those who joined in 2019 onwards*)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG4PE2B	ASTROPHYSICS	Theory	4	4

COURSE DESCRIPTION

This course intends to give an insight into versatile concepts of astronomy namely origin and evolution of universe, observation techniques, stellar evolution, fate of stars and various mechanisms of stellar energy generation.

COURSE OBJECTIVES

This course gives an overview of the universe and imparts knowledge on the sense of size and time for astronomical observation techniques. It gives a complete description of the fate of stars comprising of its birth, evolutionary stages and its ultimate fate. Also the origin , evolution and future course of the universe is detailed out.

UNIT I: LIGHT AND TELESCOPE (12 HRS)

Light and Telescopes-The spectrum-the spectral lines-what a telescope is-refracting telescopes-reflecting telescopes-spectrscopy-recording the data-electronic imaging devices-observing at short wavelengths-ultraviolet and X-ray astronomy-X-ray telescopes-observing at long wavelength-infrared astronomy-radio astronomy

UNIT II: STELLAR EVOLUTION (12 HRS)

Stellar evolution-stars in formation-stellar energy generation-atoms-stellar energy cycles-the stellar prime of life-(the neutrino experiment)-dying star-red giant-planetary nebula-white dwarfs-white dwarfs and the theory of relativity-**novae-(evolution of binary stars).(selfstudy)**

UNIT III: PULSERS (12 HRS)

Red super giants-supernovae -(cosmic rays)-neutron stars-discovery of pulsars-what are pulsars-(gravitational waves.)-The formation of stellar black hole-the photon sphere-the event horizon-rotating black hole – **detecting a black hole-non-stellar black holes (self study)**

UNIT IV: SUN (12 HRS)

The sun-basic features of the sun-the photosphere-the chromosphere-the corona-space observations of the chromosphere and the corona-sunspots and other solar activity-solar-terrestrial relations-**solar wind-solar constant. (self study)**

UNIT V: GALAXY (12 HRS)

Comets-meteoroids-astroids-chiron. Structure of Milky way galaxy-nebluae-center of our galaxy-**high-energy sources in our galaxy. (self study)** Quasars-discovery-red shift in Quasars-importance of Quasars. Big Bang Theory-General relativity theory and cosmology-steady state theory.

UNIT – 6 DYNAMISM

Impact of black holes on earth atmosphere

TEXT BOOKS:

CONTEMPORARY ASTRONOMY-JAY M. PASCHOFF

UNIT I: Chapter1-1.1-1.3, 2.1-2.5,2.10-2.13.
UNIT II: Chapter8-8.1-8.7, 9.1-9.3,9.4,9.5,9.6.9.8
UNIT III: Chapter10-10.1,10.2,(10.3),10.4,10.5,10.7,(10.12),11.1-11.6
UNIT IV: Chapter7 – 7.1-7.10
UNIT V: Chapter 20-20.1-20.4, 22.1-22.3, 27.2-27.4, 26.1- 26.3.

REFERENCE BOOKS:

1. An introduction to astrophysics by BaidhyanathBasu
2. An introduction to Modern Astrophysics by Bradley W. Caroll and Dale A.Ostlie.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 LIGHT AND TELESCOPE				
1.1	Light and Telescopes-The spectrum	2	Chalk & Talk	Black Board
1.2	spectral lines-what a telescope is-refracting telescopes	1	Chalk & Talk	Black Board
1.3	reflecting telescopes-spectroscopy-recording the data	1	Chalk & Talk	Black Board
1.4	electronic imaging devices-observing at short wavelengths	2	Chalk & Talk	Black Board
1.5	ultraviolet and X-ray astronomy	2	Lecture	LCD
1.6	X-ray telescopes-observing at long wavelength	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.7	infrared astronomy, radio astronomy	2	Lecture	Black Board
UNIT -2 STELLAR EVOLUTION				
2.1	Stellar evolution-stars in formation-stellar energy generation-atoms	3	Chalk & Talk	Black Board
2.2	stellar energy cycles-the stellar prime of life-(the neutrino experiment)-	3	Chalk & Talk	Black Board
2.3	dying star	2	Lecture	LCD
2.4	red giant-planetary nebula	1	Chalk & Talk	Black Board
2.5	white dwarfs-white dwarfs and the theory of relativity	1	Lecture	LCD
2.6	novae-(evolution of binary stars)	2	Lecture	LCD
UNIT -3 PULSERS				
3.1	Red super giants-supernovae-(cosmic rays)	2	Lecture	LCD
3.2	Neutron stars-discovery of pulsars-	2	Chalk & Talk	Black Board
3.3	What are pulsars-(gravitational waves.)	1	Lecture	LCD
3.4	The formation of stellar black hole	2	Lecture	LCD
3.5	The photon sphere	1	Chalk & Talk	Black Board
3.6	The event horizon	1	Lecture	LCD
3.7	Rotating black hole	1	Lecture	LCD
3.8	Detecting a black hole	1	Lecture	LCD

3.9	Non-stellar black holes	1	Chalk & Talk	Black Board
UNIT -4 SUN				
4.1	The sun-basic features of the sun	2	Lecture	Black Board
4.2	The photosphere	1	Lecture	LCD
4.3	The chromosphere-the corona-	2	Chalk & Talk	Black Board
4.4	Space observations of the chromosphere and the corona	2	Lecture	LCD
4.5	Sunspots and other solar activity	2	Chalk & Talk	Black Board
4.6	Solar-terrestrial relations	1	Lecture	LCD
4.7	Solar wind	1	Chalk & Talk	Black Board
4.8	Solar Constant	1	Chalk & Talk	Black Board
UNIT -5 GALAXY				
5.1	Comets-meteoroids	1	Chalk & Talk	Black Board
5.2	Asteroids-Chiron	1	Lecture	LCD
5.3	Structure of Milky way galaxy-nebulae	2	Chalk & Talk	Black Board
5.4	Center of our galaxy-high-energy sources in our galaxy	2	Chalk & Talk	Black Board
5.5	Quasars-discovery	1	Chalk & Talk	Black Board
5.6	red shift in Quasars-importance of Quasars	2	Chalk & Talk	Black Board
5.7	Big Bang theory-	1	Lecture	LCD
5.8	General relativity theory and cosmology-steady state theory	2	Chalk & Talk	Black Board

Levels	**C1**	**C2**	**C3**	**C4**	**C5**	**Total Scholastic Marks**	**Non Scholastic Marks C6**	**CIA Total**	**% of Assessment**
	T1	**T2**	**Seminar**	**Assignment**	**OBT/PPT**				

	10 Mks.	10 Mks.	5 Mks.	5 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K2	**4**	**4**	**-**	**-**	**-**	**8**	-	**8**	20 %
K3	**2**	**2**	**-**	**5**	**-**	**9**	-	**9**	22.5 %
K4	**2**	**2**	**-**	**-**	**5**	**9**	-	**9**	22.5 %
K5	**2**	**2**	**5**	**-**	**-**	**9**	-	**9**	22.5 %
Non Scholastic	**-**	**-**	**-**	**-**	-		**5**	**5**	12.5 %
Total	**10**	**10**	**5**	**5**	**5**	**35**	**5**	**40**	**100 %**

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

EVALUATION PATTERN

SCHOLASTIC					**NON - SCHOLASTIC**	**MARKS**		
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**CIA**	**ESE**	**Total**
10	**10**	**5**	**5**	**5**	**5**	**40**	**60**	**100**

- **PG CIA Components**

			Nos		
C1	-	Test (CIA 1)	1	-	10 Mks
C2	-	Test (CIA 2)	1	-	10 Mks
C3	-	Assignment	2 *	-	5 Mks
C4	-	Open Book Test/PPT	2 *	-	5 Mks
C5	-	Seminar	1	-	5 Mks
C6	-	Attendance		-	5 Mks

****The best out of two will be taken into account***

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	outline variety of objects in the Universe with a sense of scale for size and time and different types of observing techniques, instruments used in Astronomy.	K1/K2/K3	PSO1& PSO2
CO 2	acquire knowledge about the stellar evolution and mechanism of stellar energy generation	K1/K2/K3	PSO3
CO 3	gain an idea of fate of massive stars exploding as dazzling supernovae and medium mass stars condensing as neutron stars	K1/K2/K3	PSO5

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 4	explain the surface features and regions of the nearest star Sun and the impacts of the solar activities on earth.	K1/K2/K3	PSO4
CO5	obtain knowledge about the origin and evolution of the Universe and comprehend its future course..	K1/K2/K3	PSO5

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**2**	**2**	**1**
CO2	**2**	**2**	**3**	**2**	**1**
CO3	**2**	**2**	**1**	**1**	**3**
CO4	**2**	**1**	**1**	**3**	**1**
CO5	**2**	**1**	**1**	**1**	**3**

Mapping of COs with POs

CO/ PO	PO1	PO2	PO3	PO4
CO1	**3**	**2**	**3**	**1**
CO2	**1**	**3**	**2**	**2**
CO3	**3**	**1**	**1**	**1**
CO4	**3**	**2**	**1**	**1**
CO5	**2**	**2**	**1**	**3**

COURSE DESIGNER

1.Dr. M. V. Leena Chandra

2.Dr.Ancemma Joseph

Forwarded By

Dr. A. Sheela Vimala Rani

HoD's Signature & Name

I M.Sc. PHYSICS

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PAD2CA	COMPUTER APPLICATIONS LATEX	Theory & Practical	-	3

COURSE DESCRIPTION:

This course is designed to help the students to typeset articles, books, slide presentations.

COURSE OBJECTIVES:

At the end of the course the students will be able to-

CO1: Install and understand the basics of Latex

CO2: Defines commands for symbols, alignment and page layout in Latex

CO3: Create tables, figures using Latex

CO4: Write documents containing mathematical formulas using Latex

CO5: Prepare presentation, articles, books using Latex.

COURSE OUTCOME:

- Write scientific documents using Latex
- Prepares presentation using Latex

UNIT – I INTRODUCTION TO LATEX

Introduction to latex - Understanding basics in latex - Creating documents in latex - Document structure - First document - Document classes and document sectioning - Line break and new line - New paragraph

UNIT-II TYPESETTING SPECIAL SYMBOLS, ALIGNMENT, PAGE LAYOUT

Special symbols - Different fonts - Font style - Font sizes - Subscript and Superscript - Alignment - Adding horizontal and vertical space- Including comments in documents - Page layout - Drawing horizontal line - Bullets and numbering - Colouring text - Header and footer

UNIT-III TYPESETTING TABLES, WORKING WITH TABLES, INCLUDING FIURES

Tables - Simple tables - Aligning cells - Row height - Beautiful tables with book tabs package - Merging cells in a row - Naming tables - Colouring tables - Including figures – Including figures with caption

UNIT –IV MATHEMATICAL ENVIRONMENT IN LATEX

Mathematics environment in latex - Understanding basics - Aligning equations-powers, roots and fractions - Greek letters - Common sets - Common symbols\Operators - Common operations with AMS package - Bracketing - Common functions - Angles in degrees - Accents - Matrices and determinants - trigonometry functions - Limits - Derivatives - integration - double integration

UNIT-V TYPESETTING LETTER, ARTICLE, QUESTION PAPERS AND BOOK

A simple letter - A simple research article - Question papers with exam document class - Descriptive and Multiple choice questions - Books with Book document class - Content part of book - Creating title page - including list of contents - Including list of figures - Including list of Tables - Index with index package - Including Bibliography - Including Appendices

References

1.LaTeX: A document preparation system, User's guide and reference manual, Leslie Lamport, 1994, Addison Wesley

2. The Latex Companion, 2nd edition, Frank Mittelbach, Michel Goossens, Johannes Braams, David Carlisle, Chris Rowley, 2004, Addison Wesley Professional

3.LaTex for beginners by K.B.M.NambudiriPad, 2014, Alpha Science International

COURSE DESIGNER

1.Dr. R. Niranjana Devi

Forwarded By

Dr. A. Sheela Vimala Rani

HoD's Signature & Name

II M.Sc. Physics

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PGSLP1	INSTRUMENTATION AND EXPERIMENTAL METHODS	Theory	-	3

COURSE DESCRIPTION

This course enables the students to understand, analyze and implement the fundamental instrumentation and experimental methods of Physics.

COURSE OBJECTIVES

This course introduces the various instrumentation and experimentation methods encompassing data interpretation and analysis, sensors and transducers, vacuum and thin film techniques, ac and dc measurements, signal conditioning and noise

UNIT I:DATA INTERPRETATION AND ANALYSIS

Measurement, result of a measurement, sources of uncertainty and experimental error, Systematic error, random error, Reliability- chi square test, Analysis of repeated measurement, Precision and accuracy, Elementary data fitting.

UNIT II:SENSORS AND TRANSDUCERS

Transducers, Transducer characteristics, selection of a instrumentation transducer, Transducer as an electrical element, modelling external circuit components, circuit calculations, Sensors and Transducers: Temperature, Pressure, Vibration, Magnetic Field, Force and Torque, Optical.

UNIT III: VACUUM AND THIN FILM TECHNIQUES

Units of pressure measurement, characteristics of vacuum, applications of vacuum, Vacuum pumps: Rotary, oil diffusion, turbo molecular pumps, Ion pumps. Vacuum gauges: Pirani and Penning gauges. Pumping speed of a vacuum pump. Thin film techniques(overview), film thickness monitors, film thickness measurement.

UNIT IV: MEASUREMENTS

Resistance: DC and AC Measurements , Inductance Measurement: The Maxwell Bridge, Parallel Inductance bridge, Anderson bridge. Voltage Measurement: AC and DC, Current Measurement: AC and DC. Resistivity Measurement: 2-probe, 4-probe and Van-der-Paw measurements.

UNIT V: SIGNAL CONDITIONING AND NOISE

Operational amplifiers, Instrumentational amplifiers, precision absolute value circuits, True RMS to DC converters. Phase sensitive detection: Lock in amplifier, Box-car integrator, Spectrum analyzer. Noise in Circuits: Probability Density Functions, The Power Density Spectrum, Sources of noise, Introduction to Digital signal conditioning

REFERENCES

1. Measurement, Instrumentation and Experimental design in Physics and
   EngineeringMichael Sayer and AbhaiMansingh, Prentice Hall of India 2005
2. Data Reduction and Error Analysis for the Physical Sciences, P.R. Bevington and K.D Robinson, McGraw Hill, 2003
3. Electronic Instrumentation- H.S. Kalsi, TMH Publishing Co. Ltd. 997
4. Instrumentation Devices and Systems-C.S. Rangan, G.R. Sharma, V.S.V. Mani, 2nd Edition, Tata McGraw Hill, New Delhi, 1997
5. Instrumentation Measurement Analysis-B.C. Nakra, K.K. Chaudhary.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Explain the field of nanoscience to analyze and fit the experimental data with different kind of errors	K1,K2	PSO1& PSO2
CO 2	explain principle, theory and application of various sensors and transducers	K1,K3	PSO3&PSO4

CO 3	describe the various methods of vacuum and thin film measurements	K3,K3	PSO1, PSO2 &PSO3
CO 4	Discuss the basic principle and importance of the different AC and DC measurement techniques.	K2,K4	PSO1& PSO2
CO 5	Explain the developing instruments and their uses	K2,K3	PSO1, PSO2 PSO4 & PSO5

COURSE DESIGNER:

Dr.Ancemma Joseph

Forwarded By

Dr. A. Sheela Vimala Rani

HoD's Signature & Name

I M.Sc. PHYSICS

SEMESTER –II

For those who joined in 2021 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	21PG2PSL1	NANOTECHNOLOGY FOR ALL	Theory	-	3

UNIT 1

Getting Small with Nanotechnology – Grasping theEssenceofNanotechnology – Findingoutwhatitis- Thedefinition - Size comparisonsTheapplications -two approaches to fabricating at the nano scale- evolving into Nanotech - Whynanotechnology - Security– Healthcare - Resources - Whatwehave andWhatwillbeimproved –Whatwillbenew.

UNIT 2

Building a Better world with Nanomaterials - Nanomaterials Galore – It all starts with Carbon – Bond – Carbon bond – Bouncing Bucky balls – Using Bucky balls in the real world – Bucky balls as antioxidants improving medical imaging and drug delivery with Bucky balls

UNIT 3

Adding strength with composites – Composite – lighter, stronger, cheaper – interfacing the fiber with the matrix – The carbon nanotube connections – Coatingthetubes - Sonication

UNIT 4

Nano fibers – Putting nanofibers to use – clothes make the man – nanofibers – spill-resistant fabric – self- cleaning coating. Cosmetics – Making Up with nanotechnology

UNIT 5

Nanotechnology in medical applications – delivering a new drug the nanotech way – Stepping up with C60.

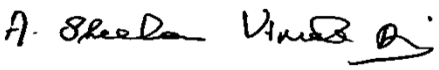
BOOK FOR STUDY

NANOTECHNOLOGY FOR DUMMIES by RICHARD BOOKER and EARL BOYSEN - Wiley Publications Inc.

UNIT 1
PART 1 - CHAPTER 1 – P9 to P19
UNIT 2
PART 11 - CHAPTER 4 - P65, 66, 69, 71,72
UNIT 3
PART 11 – CHAPTER 5 - P83, 84, 88, 89
UNIT 4
PART 11 – CHAPTER 5- P99, 100, 101, and PARTV – CHAPTER 12 P289
UNIT 5
PART IV – CHAPTER 11P249 – 267

Course Designer
Dr. L. Caroline Sugirtham

Forwarded By



Dr. A. Sheela Vimala Rani

HoD's Signature & Name

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