FATIMA COLLEGE (AUTONOMOUS)

Re-Accredited with "A++" Grade by NAAC (Cycle-IV)

74th Rank in India Ranking 2020 (NIRF) by MHRD

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 : 2023-2024

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.

M. SC., DEGREE COURSE IN PHYSICS
COURSE STRUCTURE

SEMESTER – I

COURSE COMPONENTS	NAME OF THE COURSE	CREDITS.	INST. HRS	MAX MARKS	
				CIA	EXT.
23PG1P1	Mathematical Physics	5	6	40	60
23PG1P2	Classical Mechanics and Relativity	5	6	40	60
23PG1P3	Practical I	4	6	40	60
23PG1PE1/ 23PG1PE2	Linear and Digital ICs and Applications/ Medical Physics	3	5	40	60
23PG1PE3/ 23PG1PE4	Advanced Optics/Communication Electronics	3	5	40	60
23PG1PAE	Digital Photography	1	2	40	60
	Total	**21**	**30**		

SEMESTER - II

COURSE COMPONENTS	NAME OF THE COURSE	CREDITS	INST. HRS	MAX MARKS	
				CIA	EXT.
23PG2P4	Statistical Mechanics	5	6	40	60
23PG2P5	Quantum Mechanics –I	5	6	40	60
23PG2P6	Practical – II	4	6	40	60
23PG2PE5/ 23PG2PE6	Advanced Mathematical Physics/Non-linear Dynamics	3	4	40	60
23PG2PE7/ 23PG2PE8	Microprocessor 8086 and Microcontroller 8051/ Biophysics	3	4	40	60
23PG2PAE	Modern Photography	2	4	40	60
	Total	**22**	**30**		

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
19PG3P17	Practicals-V1 Advanced Electronics Lab	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 Experiments	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 - 14 CREDITS

S. No	SEMESTER	COURSE CODE	COURSE TITLE	HRS	CREDITS	CIA Mks	ESE Mks	Total Mks
1	III	19PG3PE1A/ 19PG3PE1B	Communication System / Numerical methods and Programming C++	4	4	40	60	100
2		19PG3PSI	Summer Internship	-	3	40	60	100
3	IV	19PG4PE2A/ 19PG4PE2B	Material Science / Astro Physics	4	4	40	60	100
4		19PG4PPR	Project		3	40	60	100
		Total		8	14			

OFF-CLASSPROGRAMME

ADD-ONCOURSES

Course Code	Courses	Hrs	Credits	Semester in which the course is offered	CIA Marks	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 /CEC	-	Minimum 2 Credits	-	-	-	
19PAD4CV	**COMPREHENSIVE VIVA** (Question bank to be prepared for all the papers by the respective course teachers)	-	2	IV	-	-	100
19PAD4RC	**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 Marks	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
22PGSLP1	Digital signal Processing	-	3	III & IV	40	60	100
22PG4SLCP	Batteries and its Applications	-	3	IV	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 .

Employability,
Skill Development
100%

I M.Sc. PHYSICS

SEMESTER –I

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG1P1	MATHEMATICAL PHYSICS	Theory	6 Hrs.	5

COURSE DESCRIPTION

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

COURSE OBJECTIVES

This course provides the foundation in conceptual understanding of vectors, complex variables, matrices, special functions and Fourier and Laplace transforms required for the description of its applications in the physical phenomena

UNIT –I LINEAR VECTOR SPACE (18 HRS.)

Basic concepts – Definitions- examples of vector space – Linear independence - Scalar product- Orthogonality – Gram-Schmidt orthogonalization procedure –linear operators – Dual space- ket and bra notation – orthogonal basis – change of basis – Isomorphism of vector space – projection operator –Eigen values and Eigen functions – Direct sum and invariant subspace – orthogonal transformations and rotation

UNIT – II COMPLEX VARIABLES (18 HRS.)

Review of Complex Numbers -de Moivre's theorem-Functions of a Complex Variable- Differentiability -Analytic functions- Harmonic Functions- Complex

Integration- Contour Integration, Cauchy – Riemann conditions – Singular points – Cauchy's Integral Theorem and integral Formula -Taylor's Series - Laurent's Expansion- Zeros and poles – Residue theorem and its Application: Potential theory - (1) Electrostatic fields and complex potentials - Parallel plates, coaxial cylinders and an annular region (2) Heat problems - Parallel plates and coaxial cylinders

UNIT –III MATRICES (18 HRS.)

Types of Matrices and their properties, Rank of a Matrix -Conjugate of a matrix - Adjoint of a matrix - Inverse of a matrix - Hermitian and Unitary Matrices -Trace of a matrix- Transformation of matrices - Characteristic equation - Eigen values and Eigen vectors - Cayley–Hamilton theorem – Diagonalization

UNIT –III FOURIER TRANSFORMS& LAPLACE TRANSFORMS(18 HRS.)

Definitions -Fourier transform and its inverse - Transform of Gaussian function and Dirac delta function -Fourier transform of derivatives - Cosine and sine transforms - Convolution theorem. Application: Diffusion equation: Flow of heat in an infinite and in a semi - infinite medium - Wave equation: Vibration of an infinite string and of a semi - infinite string.

Laplace transform and its inverse - Transforms of derivatives and integrals – Differentiation and integration of transforms - Dirac delta functions - Application - Laplace equation: Potential problem in a semi - infinite strip

UNIT –V DIFFERENTIAL EQUATIONS 18 HRS.)

Second order differential equation- Sturm-Liouville's theory - Series solution with simple examples - Hermite polynomials - Generating function - Orthogonality properties - Recurrence relations – Legendre polynomials - Generating function - Rodrigue formula – Orthogonality properties - Dirac delta function- One dimensional Green's function and Reciprocity theorem - Sturm-Liouville's type equation in one dimension & their Green's function.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Solving Problems on Fourier transforms and special functions

TEXT BOOKS:

1. Mathematical Physics with classical mechanics by SatyaPrakash – Sultan chand and Sons, Fourth Revised and enlarged edition 2002

2. George Arfken and Hans J Weber, 2012, Mathematical Methods for Physicists – A Comprehensive Guide (7th edition), Academic press.

3. P.K. Chattopadhyay, 2013, *Mathematical Physics* (2nd edition), New Age, New Delhi

4. A W Joshi, 2017, Matrices and Tensors in Physics, 4th Edition (Paperback), New Age International Pvt.Ltd., India

5. B. D. Gupta, 2009, *Mathematical Physics* (4th edition), VikasPublishing House, New Delhi.

6. H. K. Dass and Dr. Rama Verma, 2014, Mathematical Physics, Seventh Revised Edition, S. Chand & Company Pvt. Ltd., New Delhi

BOOKS FOR REFERENCES:

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

2. Fourier Transforms in Physics- D.C. Champeneywiley 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

6. H. K. Dass and Dr. Rama Verma, 2014, Mathematical Physics, Seventh Revised Edition, S. Chand & Company Pvt. Ltd., New Delhi

7. E. Kreyszig, 1983, Advanced Engineering Mathematics, Wiley Eastern, New Delhi,

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 LINEAR VECTOR SPACE				
1.1	Basic concepts – Definitions- examples of vector space – Linear independence	3	Chalk & Talk	Black Board
1.2	Scalar product- Orthogonality – Gram-Schmidt orthogonalization procedure	3	Chalk & Talk	Black Board
1.3	Linear operators – Dual space- ket and bra notation	2	Lecture	Black Board
1.4	Orthogonal basis – change of basis – Isomorphism of vector space – projection operator	4	Lecture	Black Board
1.5	Eigen values and Eigen functions – Direct sum and invariant subspace	3	Lecture	Black Board
1.6	Orthogonal transformations and rotation	3	Chalk & Talk	Black Board
UNIT -2 COMPLEX ANALYSIS				
2.1	Review of Complex Numbers - de Moivre's theorem	1	Chalk& Talk	Black Board
2.2	Functions of a Complex Variable- Differentiability - Analytic functions- Harmonic Functions	3	Chalk& Talk	Black Board

2.3	Complex Integration- Contour Integration	2	Lecture	Black Board
2.4	Cauchy – Riemann conditions – Singular points – Cauchy's Integral Theorem and integral Formula	3	Lecture	Black Board
2.5	Taylor's Series - Laurent's Expansion- Zeros and poles	3	Chalk& Talk	Black Board
2.6	Residue theorem and its Application: Potential theory - (1) Electrostatic fields and complex potentials - Parallel plates, coaxial cylinders and an annular region	4	Chalk& Talk	Black Board
2.7	(2) Heat problems - Parallel plates and coaxial cylinders	2	Chalk& Talk	Black Board
UNIT - 3 MATRICES				
3.1	Types of Matrices and their properties	2	Chalk & Talk	Black Board
3.2	Rank of a Matrix - Conjugate of a matrix - Adjoint of a matrix - Inverse of a matrix	4	Chalk & Talk	Black Board
3.3	Hermitian and Unitary Matrices	2	Chalk & Talk	Black Board
3.4	Trace of a matrix- Transformation of matrices - Characteristic equation	4	Chalk & Talk	Black Board

3.5	Eigen values and Eigen vectors - Cayley–Hamilton theorem –Diagonalization	3	Chalk & Talk	Black Board
UNIT -4 FOURIER TRANSFORMS & LAPLACE TRANSFORMS				
4.1	Definitions -Fourier transform and its inverse	2	Chalk & Talk	Black Board
4.2	Transform of Gaussian function and Dirac delta function	1	Chalk & Talk	Black Board
4.3	Fourier transform of derivatives - Cosine and sine transforms - Convolution theorem.	3	Chalk & Talk	Black Board
4.4	Application: Diffusion equation: Flow of heat in an infinite and in a semi - infinite medium -	3	Lecture	Black Board
4.5	Wave equation: Vibration of an infinite string and of a semi - infinite string.	3	Chalk & Talk	Black Board
4.6	Laplace transform and its inverse - Transforms of derivatives and integrals – Differentiation and integration of transforms - Dirac delta functions	4	Chalk & Talk	Black Board
4.7	Application - Laplace equation: Potential problem in a semi - infinite strip	2	Chalk & Talk	Black Board
UNIT – 5 DIFFERENTIAL EQUATIONS				
5.1	Second order differential equation	2	Chalk & Talk	Black Board
5.2	Sturm-Liouville's theory - Series solution with simple examples -	3	Chalk & Talk	Black Board
5.3	Hermite polynomials - Generating function - Orthogonality properties - Recurrence relations	4	Chalk & Talk	Black Board

5.4	Legendre polynomials - Generating function - Rodrigue formula – Orthogonality properties	3	Chalk & Talk	Black Board
5.5	Dirac delta function- One dimensional Green's function and Reciprocity theorem	3	Chalk & Talk	Black Board
5.6	Sturm-Liouville's type equation in one dimension & their Green's function.	3	Chalk & Talk	Black Board

EVALUATION PATTERN

Levels	**C1**	**C2**	**C3**	**C4**	**C5**	**Total Scholastic Marks**	**Non Scholastic Marks C6**	**CIA Total**	**% of Assess Ment**
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks	Assignment 5 Mks	OBT/PPT 5 Mks	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

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	Define and deduce gauss	K1	PSO1& PSO2

	divergence and stokes theorem and solving problems on gauss divergence and stokes theorem		
CO 2	Discuss complex variables and Cauchy Residue Theorem	K1, K2,	PSO3
CO 3	Explain special type of matrices and its Eigen value problems	K2 & K4	PSO5
CO 4	Illustrate the properties of Fourier and Laplace transforms	K2, K3	PSO4& PSO5
CO5	Define Special 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/ PSO	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. M.Ragam**
2. **Ms. J. R. Sofia**

Forwarded By

Dr. A. SheelaVimala Rani

HoD'S Signature & Name

I M.Sc. PHYSICS

SEMESTER –I

Employability, Skill Development 100%

(*For those who joined in 2023 onwards*)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG1P2	CLASSICAL MECHANICS AND RELATIVITY	Lecture	6 Hrs.	5

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 understand fundamentals of classical mechanics.
- To understand Lagrangian formulation of mechanics and apply it to solve equation of motion.
- To understand Hamiltonian formulation of mechanics and apply it to solve equation of motion.
- To discuss the theory of small oscillations of a system.
- To learn the relativistic formulation of mechanics of a system.

UNITS

UNIT - I: PRINCIPLES OFCLASSICAL MECHANICS (18 HRS)

Mechanics of a single particle – mechanics of a system of particles – conservation laws for a system of particles – constraints – holonomic & non-holonomic constraints – generalized coordinates – configuration space – transformation equations – principle of virtual work.

UNIT - II:LAGRANGIAN FORMULATION (18 HRS)

D'Alembert's principle – Lagrangian equations of motion for conservative systems – applications: (i) simple pendulum (ii) Atwood's machine (iii) projectile motion.

UNIT III:HAMILTONIAN FORMULATION (18 HRS)

Phase space – cyclic coordinates – conjugate momentum – Hamiltonian function – Hamilton's canonical equations of motion – applications: (i) simple pendulum (ii) one dimensional simple harmonic oscillator (iii) motion of particle in a central force field.

UNIT - IV:SMALL OSCILLATIONS (18 HRS)

Formulation of the problem – transformation to normal coordinates – frequencies of normal modes – linear triatomic molecule.

UNIT - V: RELATIVITY (18 HRS)

Inertial and non-inertial frames – Lorentz transformation equations – length contraction and time dilation – relativistic addition of velocities – Einstein's mass-energy relation – Minkowski's space – four vectors – position, velocity, momentum, acceleration and force in for vector notation and their transformations.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Discussions on the current Space Missions of ISRO.

REFERENCES

TEXT BOOKS:

1. H. Goldstein, 2002, *Classical Mechanics*, 3rd Edition, Pearson Edu.
2. J. C. Upadhyaya, *Classical Mechanics*, Himalaya Publshing. Co. New Delhi.
3. R. Resnick, 1968, *Introduction to Special Theory of Relativity*, Wiley Eastern, New Delhi.
4. R. G. Takwala and P.S. Puranik, Introduction to Classical Mechanics – Tata – McGraw Hill, New Delhi, 1980.
5. N. C. Rana and P.S. Joag, Classical Mechanics - Tata McGraw Hill, 2001

REFERENCE BOOKS:

1. K. R. Symon, 1971, *Mechanics,* Addison Wesley, London.
2. S. N. Biswas, 1999, *Classical Mechanics*, Books & Allied, Kolkata.
3. Gupta and Kumar, *Classical Mechanics*, Kedar Nath.
4. T.W.B. Kibble, *Classical Mechanics*, ELBS.
5. Greenwood, *Classical Dynamics*, PHI, New Delhi.

WEB SOURCES:

1. http://poincare.matf.bg.ac.rs/~zarkom/Book_Mechanics_Goldstein_Classical_Mechanics_optimized.pdf
2. https://pdfcoffee.com/classical-mechanics-j-c-upadhyay-2014-editionpdf-pdf-free.html
3. https://nptel.ac.in/courses/122/106/122106027/
4. https://ocw.mit.edu/courses/physics/8-09-classical-mechanics-iii-fall-2014/lecture-notes/
5. https://www.britannica.com/science/relativistic-mechanics

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 PRINCIPLES OFCLASSICAL MECHANICS				
1.1	Mechanics of a single particle	2	Chalk & Talk	Black Board
1.2	Mechanics of a system of particles	2	Chalk & Talk	Black Board
1.3	Conservation laws for a system of particles	2	Chalk & Talk	Black Board
1.4	Constraints – holonomic & non-holonomic constraints	2	Chalk & Talk	Black Board
1.5	Generalized coordinates	2	Chalk & Talk	Black Board
1.6	Configuration space	3	Chalk & Talk	Black Board
1.7	Transformation equations	3	Chalk & Talk	Black Board
1.8	Principle of virtual work	2	Chalk & Talk	Black Board
UNIT -2 LAGRANGIAN FORMULATION				
2.1	D'Alembert's principle	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.2	Lagrangian equations of motion for conservative systems	3	Chalk & Talk	Black Board
2.3	Applications	3	Chalk & Talk	Black Board
2.4	Simple pendulum	3	Chalk & Talk	Black Board
2.5	Atwood's machine	3	Chalk & Talk	Black Board
2.6	Projectile motion	3	Chalk & Talk	Black Board
UNIT -3 HAMILTONIAN FORMULATION				
3.1	Phase space	3	Chalk & Talk	Black Board
3.2	Cyclic coordinates	2	Chalk & Talk	Black Board
3.3	Conjugate momentum	3	Chalk & Talk	Black Board
3.4	Hamiltonian function	2	Chalk & Talk	Black Board
3.5	Hamilton's canonical equations of motion	2	Chalk & Talk	Black Board
3.6	Applications	2	Chalk & Talk	Black Board
3.7	Simple pendulum & one dimensional simple harmonic oscillator	2	Chalk & Talk	Black Board
3.8	Motion of particle in a central force field	2	Chalk & Talk	Black Board
UNIT -4 SMALL OSCILLATIONS				

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.1	Formulation of the problem	4	Chalk & Talk	Black Board
4.2	Types of equilibrium	4	Chalk & Talk	Black Board
4.3	Eigen value equation and the principle axis transformation	4	Chalk & Talk	Black Board
4.3	Frequencies of normal modes	4	Chalk & Talk	Black Board
4.4	Linear tri atomic molecule	2	Chalk & Talk	Black Board
UNIT -5 RELATIVITY				
5.1	Inertial and non-inertial frames	2	Chalk & Talk	Black Board
5.2	Lorentz transformation equations	2	Chalk & Talk	Black Board
5.3	Length contraction and time dilation	3	Chalk & Talk	Black Board
5.4	Relativistic addition of velocities	3	Chalk & Talk	Black Board
5.5	Einstein's mass-energy relation	2	Chalk & Talk	Black Board
5.6	Minkowski's space	2	Chalk & Talk	Black Board
5.	Four vectors	2	Chalk & Talk	Black Board
5.8	Position, velocity, momentum, acceleration and force in for vector notation and their transformations	2	Chalk & Talk	Black Board

EVALUATION PATTERN

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assess Ment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks	Assignment 5 Mks	OBT/PPT 5 Mks	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

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 mechanics of single particle and system of particles and identify different types of constraints imposed on systems.	K2	PSO2, PSO3 & PSO4
CO 2	To derive Lagrange's equation equation of motion for any given system according to Lagrangian formulation.	K3	PSO2, PSO3 & PSO4
CO 3	To explain the Hamilton's canonical equation of motion and hence to discuss motion of particle in a central force field.	K3 & K5	PSO2, PSO3 & PSO4

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 4	To apply the theory of small oscillations to a linear triatomic molecule and get the normal modes and normal frequencies of the same.	K4 & K5	PSO2, PSO3 & PSO4
CO 5	Understand and apply the principles of relativistic kinematics to the mechanical systems.	K2 & K3	PSO2, PSO3 & PSO4

Mapping of C0s with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	**2**	**3**	**3**	**3**	**2**
CO2	**2**	**3**	**3**	**3**	**2**
CO3	**2**	**3**	**3**	**3**	**2**
CO4	**2**	**3**	**3**	**3**	**2**
CO5	**2**	**3**	**3**	**3**	**2**

Mapping of C0s with POs

CO/ PSO	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:

Dr. Ancemma Joseph

Dr. I. Janet Sherly

Forwarded By

Dr. A. Sheela Vimala Rani

HoD'S Signature & Name

I PG

SEMESTER –I

For those who joined in 2023 onwards

Employability, Skill Development 100%

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PAPH	23PG1P3	PRACTICAL I	Practical	6	4

COURSE DESCRIPTION

The course provides hands on training to work with fiber, Laser and young's modulus, AC bridges, Flip – Flop, and OP-AMP circuits.

COURSE OBJECTIVE/S

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

List of experiments

(Minimum of Twelve Experiments from the list)

1. Determination of Young's modulus and Poisson's ratio by Hyperbolic fringes - Cornu's Method
2. Determination of Viscosity of the given liquid – Meyer's disc
3. Measurement of Coefficient of linear expansion- Air wedge Method
4. B-H loop using Anchor ring.
5. Determination of Thickness of the enamel coating on a wire by diffraction
6. Determination of Rydberg's Constant - Hydrogen Spectrum
7. Thickness of air film - FP Etalon
8. Measurement of Band gap energy- Thermistor
9. Determination of Specific charge of an electron – Thomson's method.
10. Determination of Wavelength, Separation of wavelengths - Michelson Interferometer
11. GM counter – Characteristics and inverse square law.
12. Measurement of Conductivity - Four probe method.
13. Molecular spectra – AlO band.
14. Measurement of wavelength of Diode Laser / He – Ne Laser using Diffraction grating.
15. Measurements of Standing wave and standing wave co-efficient, Law of Inverse square, Receiver end transmitter behavior, Radiation Pattern - Microwave test bench

16. UV-Visible spectroscopy – Verification of Beer-Lambert's law and identification of wavelength maxima – Extinction coefficient
17. Construction of relaxation oscillator using UJT
18. FET CS amplifier- Frequency response, input impedance, output impedance
19. Study of important electrical characteristics of IC741.
20. V- I Characteristics of different colours of LED.
21. Study of attenuation characteristics of Wien's bridge network and design of Wien's bridge oscillator using Op-Amp.
22. Study of attenuation characteristics of Phase shift network and design of Phase shift oscillator using Op-Amp
23. Construction of Schmidt trigger circuit using IC 741 for a given hysteresis- application as squarer.
24. Construction of square wave Triangular wave generator using IC 741
25. Construction of a quadrature wave using IC 324
26. Construction of pulse generator using the IC 741 – application as frequency divider
27. Study of R-S, clocked R-S and D-Flip flop using NAND gates
28. Study of J-K, D and T flip flops using IC 7476/7473
29. Arithmetic operations using IC 7483- 4-bit binary addition and subtraction.
30. Study of Arithmetic logic unit using IC 74181.

TEXT BOOKS

1. Practical Physics, Gupta and Kumar, PragatiPrakasan.
2. Kit Developed for doing experiments in Physics- Instruction manual, R.Srinivasan K.R Priolkar, Indian Academy of Sciences.
3. Electronic Laboratory Primer a design approach, S. Poornachandra, B.Sasikala, Wheeler Publishing, New Delhi.
4. Electronic lab manual Vol I, K ANavas, Rajath Publishing.
5. Electronic lab manual Vol II, K ANavas, PHI eastern Economy Edition

REFERENCE BOOKS

1. Advanced Practical Physics, S.P Singh, PragatiPrakasan.
2. An advanced course in Practical Physics, D.Chattopadhayay, C.R Rakshit, New Central Book Agency Pvt. Ltd
3. Op-Amp and linear integrated circuit, Ramakanth A Gaykwad, Eastern Economy Edition.
4. A course on experiment with He-Ne Laser, R.S. Sirohi, John Wiley & Sons (Asia) Pvt. Ltd.
5. Electronic lab manual Vol II, Kuriachan T.D, Syam Mohan, Ayodhya Publishing

Employability,
Skill Development
100%

I M.Sc.PHYSICS

SEMESTER –I

(For those who joined in 2023 onwards)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG1PE1	LINEAR AND DIGITAL ICs AND APPLICATIONS	Theory	5	3

COURSE DESCRIPTION

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

COURSE OBJECTIVES

This course provides the foundation for conceptual understanding of the basic building blocks of linear integrated circuits, linear and non-linear applications of operational amplifiers, theory and applications of PLL, concepts of waveform generation and introduces one special function ICs and digital ICs.

UNIT I: INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER (15 HRS)

Introduction, Classification of IC's, basic information of Op-Amp 741 and its features, the ideal Operational amplifier, Op-Amp internal circuit and Op-Amp. characteristics.

UNIT II: APPLICATIONS OF OP-AMP (15 HRS)

LINEAR APPLICATIONS OF OP-AMP: Solution to simultaneous equations and differential equations, Instrumentation amplifiers, V to I and I to V converters.

NON-LINEAR APPLICATIONS OF OP-AMP:

Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveform generators.

UNIT III: ACTIVE FILTERS & TIMER AND PHASE LOCKED LOOPS (15 HRS)

ACTIVE FILTERS: Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters.

TIMER AND PHASE LOCKED LOOPS: Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, PLL - introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566), low pass filter, monolithic PLL and applications of PLL

UNIT IV: VOLTAGE REGULATOR & D to A AND A to D CONVERTERS (15 HRS)

VOLTAGE REGULATOR: Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.

D to A AND A to D CONVERTERS: Introduction, basic DAC techniques - weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters -parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

UNIT V:CMOS LOGIC, COMBINATIONAL CIRCUITS USING TTL 74XX ICs & SEQUENTIAL CIRCUITS USING TTL 74XX ICs (15 HRS)

CMOS LOGIC: CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic. COMBINATIONAL CIRCUITS USING TTL 74XX ICs: Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC 74138, IC74154),BCD to 7-segment decoder (IC7447), Encoder (IC74147), Multiplexer (IC74151), Demultiplexer (IC 74154).

SEQUENTIAL CIRCUITS USING TTL 74XX ICs: Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493).

UNIT –VI DYNAMISM

Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism

TEXT BOOK

1. D. Roy Choudhury, Shail B. Jain (2012), Linear Integrated Circuit, 4th edition, New Age International Pvt. Ltd., New Delhi, India
2. Ramakant A. Gayakwad, (2012), OP-AMP and Linear Integrated Circuits, 4th edition, Prentice Hall / Pearson Education, New Delhi.
3. B.L. Theraja and A.K. Theraja, 2004, A Textbook of Electrical technology, S. Chand & Co.
4. V.K. Mehta and Rohit Mehta, 2008, Principles of Electronics, S. Chand & Co, 12th Edition.
5. V. Vijayendran, 2008, Introduction to Integrated electronics (Digital & Analog), S. Viswanathan Printers & Publishers Private Ltd, Reprint. V.

BOOKS FOR REFERENCE

1. Sergio Franco (1997), Design with operational amplifiers and analog integrated circuits, McGraw Hill, New Delhi.
2. Gray, Meyer (1995), Analysis and Design of Analog Integrated Circuits, Wiley International, New Delhi.
3. Malvino and Leach (2005), Digital Principles and Applications 5th Edition, Tata McGraw Hill, New Delhi
4. Floyd, Jain (2009), Digital Fundamentals, 8th edition, Pearson Education, New Delhi.
5. Integrated Electronics, Millman & Halkias, Tata McGraw Hill, 17th Reprint (2000)

WEB SOURCES

1. https://nptel.ac.in/course.html/digital circuits/
2. https://nptel.ac.in/course.html/electronics/operational amplifier/
3. https://www.allaboutcircuits.com/textbook/semiconductors/chpt-7/field-effect-controlled-thyristors/
4. https://www.electrical4u.com/applications-of-op-amp/
5. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 FIELD EFFECT TRANSISTORS				
1.1	Introduction	2	Chalk & Talk	Black Board
1.2	Classification of IC's	3	Chalk & Talk	Black Board
1.3	Basic information of Op-Amp 741 and its features	3	Chalk & Talk	Black Board
1.4	The ideal Operational amplifier	3	Chalk & Talk	Black Board
1.5	Op-Amp internal circuit and Op-Amp. Characteristics.	4	Chalk & Talk	Black Board
UNIT -2 LINEAR ANALOG SYSTEMS				
2.1	Solution to simultaneous equations and differential equations	2	Chalk & Talk	Black Board
2.2	Instrumentation amplifiers, V to I and I to V converters	3	Chalk & Talk	Black Board
2.3	Sample and Hold circuit, Log and Antilog amplifier	2	Chalk & Talk	Black Board
2.4	multiplier and divider, Comparators	2	Chalk & Talk	Black Board
2.5	Schmitt trigger	2	Lecture	LCD
2.6	Multivibrators	2	Chalk & Talk	Black Board
2.7	Triangular and Square waveform generators	2	Lecture	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -3 NON-LINEAR ANALOG SYSTEMS				
3.1	Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters	3	Chalk & Talk	Black Board
3.2	band pass, band reject and all pass filters.	2	Chalk & Talk	Black Board
3.3	Introduction to IC 555 timer, description of functional diagram	3	Chalk & Talk	Black Board
3.4	Monostable and astable operations and applications, Schmitt trigger	2	Chalk & Talk	Black Board
3.5	PLL - introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566)	3	Chalk & Talk	Black Board
3.6	low pass filter, monolithic PLL and applications of PLL	2	Chalk & Talk	Black Board
UNIT -4 REGISTERS AND COUNTERS				
4.1	Introduction, Series Op-Amp regulator	2	Lecture	Black Board
4.2	Voltage Regulators, IC 723 general purpose regulators	2	Lecture	LCD
4.3	Switching Regulator, D to A AND A to D CONVERTERS: Introduction	3	Chalk & Talk	Black Board
4.4	Basic DAC techniques - weighted resistor DAC, R-2R ladder DAC	2	Lecture	LCD
4.5	Inverted R-2R DAC, A to D converters -parallel comparator type ADC	1	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.6	Counter type ADC	2	Chalk & Talk	Black Board
4.7	Successive approximation ADC and dual slope ADC	1	Chalk & Talk	Black Board
4.8	DAC and ADC Specifications	2	Chalk & Talk	Black Board
UNIT -5 ANALOG TO DIGITAL CONVERSIONS				
5.1	CMOS LOGIC: CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic.	3	Chalk & Talk	Black Board
5.2	COMBINATIONAL CIRCUITS USING TTL 74XX ICs: Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC 74138, IC74154),BCD to 7-segment decoder (IC7447)	3	Chalk & Talk	Black Board
5.3	Encoder (IC74147), Multiplexer (IC74151), Demultiplexer (IC 74154).	3	Chalk & Talk	Black Board
5.4	SEQUENTIAL CIRCUITS USING TTL 74XX ICs: Flip Flops (IC 7474, IC 7473),	2	Chalk & Talk	Black Board
5.5	Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493).	3	Chalk & Talk	Black Board

EVALUATION PATTERN

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assess Ment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks	Assignment 5 Mks	OBT/PPT 5 Mks	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

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
CO1	Learn about the basic concepts for the circuit configuration for the design of linear integrated circuits and develops skill to solve problems	K1, K5	PSO1,PSO2& PSO3
CO2	Develop skills to design linear and non-linear applications circuits using Op-Amp and design the active filters circuits.	K3	PSO5
CO3	Gain knowledge about PLL, and develop the skills to design the simple circuits using IC 555 timer and can solve problems related to it.	K1, K3	PSO2,PSO3

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO4	Learn about various techniques to develop A/D and D/A converters.	K2	PSO4,PSO5
CO5	Acquire the knowledge about the CMOS logic, combinational and sequential circuits.	K1, K4	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

R.NIRANJANA DEVI

Forwarded By

Dr. A. Sheela Vimala Rani

HoD's Signature & Name

Employability, Skill Development 100%

I M.Sc.,PHYSICS

SEMESTER –I

(For those who joined in 2023 onwards)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG1PE2	Medical Physics	Lecture	5 Hrs.	3

COURSE DESCRIPTION

This course aims to introduce to students, application of physics in the field of medicine, encompassing the principle and working of medical devices such as X-ray, Sphygmomanometer, Ultrasonic imaging as well as concepts on Radiation Protection.

COURSE OBJECTIVES

To understand the major applications of Physics to Medicine
To study the aid of different medical devices such as X-ray machines, gamma camera, accelerator and nuclear magnetic resonance.
To outline the principles of Physics of different medical radiation devices and their modern advances, especially in medical radiation therapy and different applications in medical physics.
To introduce the ideas of Radiography.
To form a good base for further studies like research.

UNITS

UNIT I: X-RAYS AND TRANSDUCERS [15 HRS]

Electromagnetic Spectrum – Production of X-Rays – X-Ray Spectrum – Bremsstrahlung – Characteristic X-Ray – X-Ray Tubes – Coolidge Tube – X-Ray Tube Design – Thermistors – photo electric transducers – Photo voltaic cells – photo emissive cells –Photoconductive cells– piezoelectric transducer

UNIT II: BLOOD PRESSURE MEASUREMENTS[15 HRS]Introduction – sphygmomanometer – Measurement of heart rate – basic principles of electrocardiogram (ECG) –Basic principles of electro-neurography (ENG) – Basic principles of magnetic resonance imaging (MRI).

UNIT III: RADIATION PHYSICS [15 HRS]

Radiation Units – Exposure – Absorbed Dose – Rad to Gray – Kera Relative Biological Effectiveness –Effective Dose – Sievert (Sv) – Inverse Square Law –

Interaction of radiation with Matter – Linear Attenuation Coefficient – Radiation Detectors –Thimble Chamber – Condenser Chambers – Geiger Counter – Scintillation Counter

UNIT IV :MEDICAL IMAGING PHYSICS [15 HRS]

Radiological Imaging – Radiography – Filters – Grids – Cassette – X-Ray Film – Film processing – Fluoroscopy – Computed Tomography Scanner – Principal Function – Display – Mammography – Ultrasound Imaging – Magnetic Resonance Imaging – Thyroid Uptake System – Gamma Camera (Only Principle, Function and display)

UNIT V :RADIATION PROTECTION [15 HRS]

Principles of Radiation Protection – Protective Materials – Radiation Effects – Somatic – Genetic Stochastic and Deterministic Effect – Personal Monitoring Devices – TLD Film Badge – Pocket Dosimeter

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Radiation from Nuclear Power plants –Standards for Protection against Ionizing Radiation

TEXT BOOKS:

1. Dr.K.Thayalan ,Basic Radiological Physics, Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi, 2003.
2. Curry, Dowdey and Murry, Christensen's Physics of Diagnostic Radiology: -LippincotWilliams and Wilkins, 1990.
3. FM Khan, Physics of Radiation Therapy, William and Wilkins, 3rd ed, 2003.
4. D. J. Dewhurst, An Introduction to Biomedical Instrumentation, 1st ed, Elsevier Science, 2014.
5. R.S. Khandpur, Hand Book of Biomedical Instrumentations, 1st ed, TMG, New Delhi, 2005.

BOOKS FOR REFERENCE

1. Muhammad Maqbool, An Introduction to Medical Physics, 1st ed, Springer International Publishing, 2017.
2. Daniel Jirák, FrantišekVítek, Basics of Medical Physics, 1st ed, Charles University, Karolinum Press, 2018
3. Anders Brahme, Comprehensive Biomedical Physics, Volume 1, 1st ed, Elsevier Science, 2014.
4. K. Venkata Ram, Bio-Medical Electronics and Instrumentation, 1st ed, Galgotia Publications, New Delhi, 2001.
5. John R. Cameron and James G. Skofronick, 2009, Medical Physics, John Wiley Interscience Publication, Canada, 2nd edition.

WEB SOURCES

1. **https:nptel.ac.in/courses/108/103/108103157/**
2. **https://www.studocu.com/en/course/university-of-technology-sydney/medical-devices-and-diagnostics/225692**
3. **https://www.technicalsymposium.com/alllecturenotes_biomed.html**
4. **https://lecturenotes.in/notes/17929-note-for-biomedical-instrumentation-bi-by-deepraj-adhikary/78**
5. **https://www.modulight.com/applications-medical/**

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 X-RAYS AND TRANSDUCERS				
1.1	Electromagnetic Spectrum – Production of X-Rays – X-Ray Spectrum	3	Chalk & Talk	Black Board
1.2	Bremsstrahlung – Characteristic X-Ray	2	Chalk & Talk	Black Board
1.3	X-Ray Tubes – Coolidge Tube – X-Ray Tube Design	3	Chalk & Talk	Black Board
1.4	Thermistors – photo electric transducers	3	Chalk & Talk	Black Board
1.5	Photo voltaic cells – photo emissive cells	2	Lecture	LCD
1.6	Photoconductive cells– piezoelectric transducer	2	Lecture	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -2 BLOOD PRESSURE MEASUREMENTS				
2.1	Introduction– sphygmomanometer	2	Chalk & Talk	Black Board
2.2	Measurement of heart rate	3	Chalk & Talk	Black Board
2.3	Basic principles of electrocardiogram (ECG)	4	Chalk & Talk	Black Board
2.4	Basic principles of electro-neurography (ENG)	3	Chalk & Talk	Black Board
2.5	Basic principles of magnetic resonance imaging (MRI).	3	Lecture	LCD
UNIT -3RADIATION PHYSICS				
3.1	Radiation Units – Exposure – Absorbed Dose	2	Chalk & Talk	Black Board
3.2	Rad to Gray – Kera Relative Biological Effectiveness – Effective Dose	3	Chalk & Talk	Black Board
3.3	Sievert (Sv) – Inverse Square Law – Interaction of radiation with Matter – Linear Attenuation Coefficient	4	Chalk & Talk	Black Board
3.4	Radiation Detectors –Thimble Chamber	3	Chalk & Talk	Black Board
3.5	Condenser Chambers – Geiger Counter – Scintillation Counter	3	Chalk & Talk	Black Board
UNIT -4 MEDICAL IMAGING PHYSICS				
4.1	Radiological Imaging – Radiography	2	Lecture	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.2	Filters – Grids – Cassette – X-Ray Film – Film processing	2	Lecture	LCD
4.3	Fluoroscopy – Computed Tomography Scanner	2	Chalk & Talk	Black Board
4.4	Principal Function – Display – Mammography	3	Lecture	LCD
4.5	Ultrasound Imaging – Magnetic Resonance Imaging	3	Chalk & Talk	Black Board
4.6	Thyroid Uptake System	3	Lecture	LCD
UNIT -5 RADIATION PROTECTION				
5.1	Principles of Radiation Protection	3	Chalk & Talk	Black Board
5.2	Protective Materials – Radiation Effects	4	Lecture	LCD
5.3	Somatic – Genetic Stochastic and Deterministic Effect	4	Chalk & Talk	Black Board
5.4	Personal Monitoring Devices – TLD Film Badge – Pocket Dosimeter	4	Chalk & Talk	Black Board

EVALUATION PATTERN

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assess Ment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks	Assignment 5 Mks	OBT/PPT 5 Mks	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

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	Learn the fundamentals, production and applications of X-rays.	K1,K2	PSO1& PSO2
CO 2	Understand the basics of blood pressure measurements. Learn about sphygmomanometer, EGC, ENG and basic principles of MRI.	K2	PSO3
CO 3	Apply knowledge on Radiation Physics	K1 , K2	PSO5
CO 4	Analyze Radiological imaging and filters	K2, K3	PSO2,PSO3
CO 5	Assess the principles of radiation protection	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**	**2**	**2**	**1**
CO3	**2**	**3**	**3**	**1**	**3**
CO4	**2**	**1**	**2**	**3**	**3**
CO5	**2**	**1**	**2**	**2**	**3**

Mapping of COs with POs

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

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

♦ Weakly Correlated -**1**

COURSE DESIGNER:

Ms. J. R. Sofia

Forwarded By

Dr. A. SheelaVimala Rani

HoD'S Signature & Name

Employability,
Skill Development
100%

I MSC PHYSICS

SEMESTER –I

(*For those who joined in 2023 onwards*)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG1PE3	Advanced Optics	Lecture	5 Hrs.	3

COURSE DESCRIPTION

This course introduces ray properties and wave nature of light. And also introduces about magneto and electro optics.

COURSE OBJECTIVES

To enable the student to understand the basic concepts of polarization and double refraction, applications of various lasers, Non linear optics process, fiber optics and their types and various effects in magneto and electro optics.

UNITS

UNIT –I : POLARIZATION AND DOUBLE REFRACTION (15 HRS.)

Introduction- Production of polarized light : Wire grid polarizer and the polaroid – Polarization by reflection – Polarization by double refraction – Polarization by scattering. Malu's law - The phenomenon of double refraction (Normal and oblique incidence). Analysis of polarized light .

UNIT –II : LASERS (15 HRS.)

Basic principles – Spontaneous and stimulated emissions – Components of the laser – Resonator and lasing action – Types of lasers and its applications – Solid state lasers – Ruby laser – Nd:YAG laser – gas lasers – He-Ne laser – CO_2 laser – Chemical lasers – HCl laser – Semiconductor laser

UNIT –III : FIBER OPTICS (15HRS.)

Introduction – Total internal reflection – The optical fiber – Glass fibers – The coherent bundle – The numerical aperture – Attenuation in optical fibers – Single and multi-mode fibers – Pulse dispersion in multimode optical fibers – Ray dispersion in multimode step index fibers – Parabolic-index

fibers – Fiber-optic sensors: precision displacement sensor – Precision vibration sensor

UNIT–IV : NON-LINEAR OPTICS (15HRS.)

Basic principles – Harmonic generation – Second harmonic generation – Phase matching – Third harmonic generation – Optical mixing – Parametric generation of light – Self-focusing of light

UNIT –V : MAGNETO-OPTICS AND ELECTRO-OPTICS (15HRS.)

Magneto-optical effects – Zeeman effect – Inverse Zeeman effect – Faraday effect – Voigt effect – Cotton-mouton effect – Kerr magneto-optic effect – Electro-optical effects – Stark effect – Inverse stark effect – Electric double refraction – Kerr electro-optic effect – Pockels electro-optic effect

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Applications of lasers , Non linear optics and fiber optics in daily life.

TEXT BOOK:

1. Ajoy Ghatak, 2017, Optics, 6th Edition, McGraw – Hill Education Pvt. Ltd.
   Unit I : 18.1 – 18.3. 18.5 & 18.7.
2. B. B. Laud, 2017, Lasers and Non – Linear Optics, 3rd Edition, New Age International (P) Ltd.
   Unit II : 6.1-6.3,7.1-7.3,7.5(a),8.5-8.5.1,9.1-9.5,10.3-10.3.1
   Unit IV : 13.1 – 13.7.
3. F. S. Jenkins and H. E. White, 1981, Fundamentals of Optics, (4th Edition), McGraw – Hill International Edition.
   Unit V : 32.1 – 32.11.
   4. J. Peatros, Physics of Light and Optics, a good(and free) electronic book.
   5. B. Saleh nd M.Tech, Fundamentals of Photonics, Wiley-Interscience.

REFERENCES:

1. F. S. Jenkins and H. E. White, 1981, Fundamentals of Optics, (4th Edition), McGraw – Hill International Edition.
2. Dieter Meschede, 2004, Optics, Light and Lasers, Wiley – VCH, Varley GmbH.
3. Lipson, S. G. Lipson and H. Lipson, 2011, Optical Physics, 4th Edition,

Cambridge University Press, New Delhi, 2011.

4. Y. B. Band, Light and Matter, Wiley and Sons (2006)
5. R. Guenther, Modern Optics, Wiley and Sons (1990)

Web Reference

1. https://www.youtube.com/watch?v=WgzynezPiyc
2. https://www.youtube.com/watch?v=ShQWwobpW60
3. https://www.ukessays.com/essays/physics/fiber–optics–and–it-applications.php
4. https://www.youtube.com/watch?v=0kEvr4DKGRI
5. http://optics.byu.edu/textbook.aspx

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 POLARIZATION AND DOUBLE REFRACTION				
1.1	Introduction and Classification of polarization	2	Chalk & Talk	Black Board
1.2	Transverse character of light waves and Polarizer and analyzer	1	Chalk & Talk	Black Board
1.3	Malu's law and Production of polarized light	2	Chalk & Talk	Black Board
1.4	Wire grid polarizer and the polaroid & Polarization by reflection	2	Chalk & Talk	Black Board
1.5	Polarization by double refraction & Polarization by scattering	2	Chalk & Talk	Black Board
1.6	The phenomenon of double refraction & Normal and oblique incidence	2	Chalk & Talk	Black Board
1.7	Interference of polarized light: Quarter and half wave plates	2	Chalk & Talk	Black Board
1.8	Analysis of polarized light &	2	Chalk &	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	Optical activity		Talk	Board
UNIT -2 LASERS				
2.1	Introduction and Basic principles	2	Chalk & Talk	Black Board
2.2	Spontaneous and stimulated emissions	1	Chalk & Talk	Black Board
2.3	Components of the laser	1	Chalk & Talk	Black Board
2.4	Resonator and lasing action	1	Chalk & Talk	Black Board
2.5	Types of lasers and its applications	2	Chalk & Talk	Black Board
2.6	Solid state lasers & Ruby laser	2	Chalk & Talk	Black Board
2.7	Nd:YAG laser & gas lasers	2	Chalk & Talk	Black Board
2.8	He-Ne laser & CO_2 laser	2	Chalk & Talk	Black Board
2.9	Chemical lasers & HCl laser	1	Chalk & Talk	Black Board
2.10	Semiconductor laser	1	Chalk & Talk	Black Board
UNIT -3 FIBER OPTICS				
3.1	Introduction	1	Chalk & Talk	Black Board
3.2	Total internal reflection	1	Chalk & Talk	Black Board
3.3	The optical fiber & Glass fibers	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.4	The coherent bundle, The numerical aperture & Attenuation in optical fibers	2	Chalk & Talk	Black Board
3.5	Single and multi mode fibers	2	Chalk & Talk	Black Board
3.6	Pulse dispersion in multimode optical fibers Ray dispersion in multimode step index fibers	2	Chalk & Talk	Black Board
3.7	Parabolic &index fibers	2	Chalk & Talk	Black Board
3.8	Fiber-optic sensors: precision displacement sensor	2	Chalk & Talk	Black Board
3.9	Precision vibration sensor	1	Chalk & Talk	Black Board
UNIT -4 NON-LINEAR OPTICS				
4.1	Introduction &c Basic principles	2	Chalk & Talk	Black Board
4.2	Harmonic generation & Phase matching	2	Chalk & Talk	Black Board
4.3	Second & Third harmonic generation	3	Chalk & Talk	Black Board
4.4	Optical mixing	2	Chalk & Talk	Black Board
4.5	Parametric generation of light	3	Chalk & Talk	Black Board
4.6	Self-focusing of light	3	Chalk & Talk	Black Board
UNIT -5MAGNETO-OPTICS AND ELECTRO-OPTICS				
5.1	Introduction & Magneto-optical effects	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.2	Zeeman effect & Inverse Zeeman effect	2	Chalk & Talk	Black Board
5.3	Faraday effect & Voigt effect	2	Chalk & Talk	Black Board
5.4	Cotton-mouton effect & Kerr magneto-optic effect	2	Chalk & Talk	Black Board
5.5	Electro-optical effects & Stark effect	2	Chalk & Talk	Black Board
5.6.	Inverse stark effect & Electric double refraction	2	Chalk & Talk	Black Board
5.7	Kerr electro-optic effect & Pockels electro-optic effect	3	Chalk & Talk	Black Board

EVALUATION PATTERN

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assess Ment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks	Assignment 5 Mks	OBT/PPT 5 Mks	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

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	Understand the concept of polarization of light, production methods and double refraction.	K2	PSO1, PSO2, PSO3
CO 2	Understand the working of different types of LASERS	K2	PSO1, PSO2, PSO3
CO 3	Explain the types of fiber optics and their potential applications potential well; To discuss the problem of barrier penetration.	K3	PSO1, PSO2, PSO3, PSO5
CO 4	Differentiate first and second harmonic generation and explain their applications	K2, K3	PSO1, PSO2, PSO3, PSO5
CO 5	Describe the principles of magneto-optic and electro-optic effects and its applications	K3 & K4	PSO1, PSO2, PSO3, PSO5

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/ PSO	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:

Dr. R.Jothi Mani

Dr.J.Selvi

Forwarded By

Dr. A. Sheela Vimala Rani

HoD'S Signature & Name

Employability, Skill Development 100%

I M.Sc.PHYSICS

SEMESTER –I

(For those who joined in 2023 onwards)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG1PE4	Communication Electronics	Lecture	5 Hrs.	3

COURSE DESCRIPTION

This course introduces the working principle of fiber optics and its use in telecommunication.

COURSE OBJECTIVES

- To comprehend the transmission of electromagnetic waves through different types of antenna and also to acquire knowledge about the propagation of waves through earth's atmosphere and along the surface of the earth
- To gain knowledge in the generation and propagation of microwaves
- To acquire knowledge about radar systems and its applications and also the working principle of colour television
- To understand the general theory and operation of satellite communication systems

UNITS

UNIT –I ANTENNAS AND WAVE PROPAGATION (15 HRS)

Radiation field and radiation resistance of short dipole antenna-grounded antenna-ungrounded antenna-antenna arrays-broadside and end side arrays-antenna gain-directional high frequency antennas-sky wave-ionosphere- Ecles and Larmor theory- Magnento ionic theory-ground wave propagation

UNIT –II MICROWAVES (15 HRS)

Microwave generation—multicavity Klystron-reflex klystron-magnetrontravelling wave tubes (TWT) and other microwave tubes-MASER-

Gunndiode-wave guides-rectangular wave guides-standing wave indicator andstanding wave ratio(SWR)

UNIT –III RADAR ANDTELEVISION (15HRS)

Elements of a radar system-radar equation-radar performance Factorsradar transmitting systems-radar antennas-duplexers-radarreceivers and indicators-pulsed systems-other radar systems-colour TVtransmission and reception-colour mixing principle-colour picture tubes-Delta gun picture tube-PIL colour picture tube-cable TV, CCTV and theatre TV

UNIT–IV OPTICAL FIBER (15HRS)

Propagation of light in an optical fibre-acceptance angle-numericalaperture-step and graded index fibres-optical fibres as a cylindrical waveguide-wave guide equations-wave guide equations in step index fibres -fibre losses and dispersion-applications

UNIT –V SATELLITECOMMUNICATION (15HRS)

Orbital satellites-geostationary satellites-orbital patterns-satellite systemlink models-satellite system parameters-satellite system link equationlinkbudget-INSAT communication satellites

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Fibre optics in telecommunication and operation of satellite communication system.

TEXT BOOK:

1. Handbook of Electronics by Gupta and Kumar, 2008 edition.
2. Electronic communication systems – George Kennedy and Davis, Tata McGraw Hill, 4th edition, 1988.
3. Taub and Schilling, principles of communication systems, second edition, Tata Mc Graw Hill (1991).
4. M. Kulkarani, Microwave and radar engineering, UmeshPublications, 1998.
5. Mono Chrome and colour television, R. R. Ghulathi

REFERENCES:

1. Electronic communications – Dennis Roody and Coolen, Prentice Hall of India, IV edition, 1995.
2. Wayne Tomasi, Advanced electronics communication systems, fourth edition, Prentice Hall of India, 1998
3. Dennis Roddy and Coolen,1995,*Electronics communications,*Prentice Hall of India IV Edition.
4. Wayne Tomasi,1998 *"Advanced Electronics communication System"* 4thedition, Prentice Hall of India, 1998
5. S. Salivahanan, N. Suersh Kumar & A. Vallavaraj, 2009, Electronic Devices and Circuits, Tata McGraw-Hill Publishing Company Limited, New Delhi, Second Edition.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 ANTENNAS AND WAVE PROPAGATION				
1.1	Radiation field and radiation resistance of short dipole antenna	2	Chalk & Talk	Black Board
1.2	Grounded antenna-ungrounded antenna	2	Chalk & Talk	Black Board
1.3	Antenna arrays - broadside and end side arrays-antenna gain	2	Chalk & Talk	Black Board
1.4	Directional high frequency antennas	3	Chalk & Talk	Black Board
1.5	Sky wave-ionosphere- Ecles and Larmor theory	3	Chalk & Talk	Black Board
1.6	Magnento ionic theory-ground wave propagation	3	Chalk & Talk	Black Board
UNIT -2 MICROWAVES				
2.1	Microwave generation— multicavity Klystron-reflex klystron	3	Chalk & Talk	Black Board
2.2	magnetron -travelling wave tubes (TWT) and other	3	Chalk &	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	microwave tubes		Talk	Board
2.3	MASER-Gunn diode-wave guides	3	Chalk & Talk	Black Board
2.4	rectangular wave guides	3	Chalk & Talk	Black Board
2.5	standing wave indicator and standing wave ratio(SWR)	3	Chalk & Talk	Black Board
UNIT -3 RADAR AND TELEVISION				
3.1	Elements of a radar system-duplexers	3	Chalk & Talk	Black Board
3.2	Radar performance factors	3	Chalk & Talk	Black Board
3.3	Radar equation- radar transmitting systems-radar antennas- Radar receivers and indicators-pulsed systems	3	Chalk & Talk	Black Board
3.4	Other radar systems-colour TV transmission and reception	3	Chalk & Talk	Black Board
3.5	Colour mixing principle-colour picture tubes	2	Chalk & Talk	Black Board
3.6	Delta gun picture tube-PIL colour picture tube - Cable TV, CCTV and theatre TV	1	Chalk & Talk	Black Board
UNIT -4 OPTICAL FIBER				
4.1	Propagation of light in an optical fibre	2	Chalk & Talk	Black Board
4.2	Acceptance angle-numerical aperture	2	Chalk & Talk	Black Board
4.3	Step and graded index fibres	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.4	Optical fibres as a cylindrical waveguide	3	Chalk & Talk	Black Board
4.5	Wave guide equations-wave guide equations in step index fibres	3	Chalk & Talk	Black Board
4.6	Fibre losses and dispersion-applications	3	Chalk & Talk	Black Board
UNIT -5 SATELLITE COMMUNICATION				
5.1	Orbital satellites and geostationary satellites	3	Chalk & Talk	Black Board
5.2	orbital patterns	3	Chalk & Talk	Black Board
5.3	satellite system link models-satellite system parameters	3	Chalk & Talk	Black Board
5.4	satellite system link equation link budget	3	Chalk & Talk	Black Board
5.5	INSAT communication satellites	3	Chalk & Talk	Black Board

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	Discuss and compare the propagation of electromagnetic waves through sky and on earth's surface Evaluate the energy and	K1, K5	PSO1, PSO2, PSO3

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
	power radiated by the different types of antenna		
CO 2	Compare and differentiate the methods of generation of microwaves analyze the propagation of microwaves through wave guides- discuss and compare the different methods of generation of microwaves	K4	PSO1, PSO2, PSO3
CO 3	Classify and compare the working of different radar systems- apply the principle of radar in detecting locating, tracking, and recognizing objects of various kinds at considerable distances – discuss the importance of radar in military- elaborate and compare the working of different picture tube	K3	PSO1, PSO2, PSO3, PSO5
CO 4	Classify, discuss and compare the different types of optical fiber and also to justify the need of it-discover the use of optical fiber as wave guide	K1, K3	PSO1, PSO2, PSO3, PSO5
CO 5	Explain the importance of satellite communication in our daily life- distinguish between orbital and geostationary satellites elaborate the linking of satellites with ground station on the earth	K4	PSO1, PSO2, PSO3, PSO5

EVALUATION PATTERN

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assess Ment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks	Assignment 5 Mks	OBT/PPT 5 Mks	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

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***

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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/ PSO	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:

Dr. I. Janet Sherly

Forwarded By

Dr. A. Sheela Vimala Rani

HoD'S Signature & Name

Employability,
Skill Development
100%

SEMESTER –I

(*For those who joined in 2023 onwards*)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG1PAE	DIGITAL PHOTOGRAPHY	Lecture	2 Hrs.	1

COURSE DESCRIPTION

This course will familiarize the students with the fundamental ideas of lens and camera.

COURSE OBJECTIVES

This course focuses on core photographic concepts like the uses of photography in daily life, basic parts of camera, Focusing Aspects, composition techniques of photography and indoor and outdoor subjects in photography.

UNITS

UNIT I: INTRODUCTION TO PHOTOGRAPHY (6 HRS)

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

UNIT II: LENS (6 HRS)

Introduction - focal length - speed of the lens- Special lenses - wide angle lens-telephoto lens – close up lens- zoom lens.

UNIT III: FOCUSING ASPECTS (6 HRS)

F-number – Aperture – shutter speed – lighting-contrast-Exposure-illumination and use of flash light

UNIT IV: COMPOSITION (6 HRS)

Rules for composition of photography – View Point – Subject Arrangement – Sharpness – Scale – Tone – Key of the Picture – Format.

UNIT –V: PRACTICING SUBJECTS (6 HRS)

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

UNIT –VI DYNAMISM (For CIA only)

Applications of photography in daily life. Hands on training with camera

TEXT BOOK:

1. S.Thiagarajan (2007, IV edition), *The New Practical Photography,* Sultan Chand & Sons.
2. Vinay Ahlawat, Gaurav Birla, Photography, Vikas Publishers.

REFERENCE BOOKS:

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

Web Sources:

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

3. COURSE CONTENTS & LECTURE SCHEDULE:

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

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 Introduction to Photography				
1.1	Introduction to photography	1	Lecture	Black Board
1.2	Personal uses	1	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 & Important controls	1	Lecture	Black Board & LCD
1.6	Types of camera	1	Lecture	PPT
UNIT -2 LENS				
2.1	Introduction	1	Lecture	LCD
2.2	Focal length	1	Lecture	LCD
2.3	Speed of the lens	1	Lecture	LCD
2.4	Wide angle lens & Special lenses & Telephoto lens	1	Lecture	LCD
2.5	Close up lens & zoom lens & Introducing the technical knowledge of using a SLR camera.	2	Lecture	LCD
UNIT - 3 Focusing Aspects				

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
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
UNIT – 4 COMPOSITION				
4.1	Rules for composition of photography & View Point	1	Lecture	PPT
4.2	Subject Arrangement & Sharpness	1	Lecture	PPT
4.3	Scale & Tone	2	Lecture	PPT
4.4	Key of the Picture & Format	2	Lecture	PPT
UNIT-5 PRACTICING INDOOR SUBJECTS				
5.1	Introduction	1	Lecture	PPT
5.2	Practicing indoor subjects like Passport	2	Lecture	PPT
5.3	Portrait, Article & Still life subjects	2	Lecture	PPT
5.4	Outdoor subjects like landscape and moving object photography	1	Lecture	PPT

EVALUATION PATTERN

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assess Ment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks	Assignment 5 Mks	OBT/PPT 5 Mks	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

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	Understand the basic concepts of photography	K2	PSO1, PSO2, PSO3
CO 2	Discuss the different types of lenses and to introduce the technical knowledge of SLR camera.	K2	PSO1, PSO2, PSO3
CO 3	Understand the focusing aspects of camera.	K3	PSO1, PSO2, PSO3, PSO5
CO 4	To understand the composition techniques of photography	K2, K3	PSO1, PSO2, PSO3, PSO5
CO 5	To understand the types of photography and practising indoor and outdoor objects	K3 & K4	PSO1, PSO2, PSO3, PSO5

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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/ PSO	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:

Dr. R. Jothi Mani

Dr. I. Janet Sherly

Forwarded By

Dr. A. Sheela Vimala Rani

HoD'S Signature & Name

Employability,
Skill Development
100%

I MSC PHYSICS

SEMESTER –II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG2P4	STATISTICAL MECHANICS	Core	6	5

COURSE DESCRIPTION

This course develops concepts in Classical statistical mechanics, Quantum statistics and fluctuations .

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 6

UNIT –I PHASE TRANSITIONS (18 HRS)

Thermodynamic potentials - Phase Equilibrium - Gibb's phase rule - Phase transitions and Ehrenfest's classifications –Third law of Thermodynamics. Order parameters – Landau's theory of phase transition - Critical indices - Scale transformations and dimensional analysis.

UNIT –II STATISTICAL MECHANICS AND THERMODYNAMICS (18 HRS)

Foundations of statistical mechanics - Specification of states of a system - Micro canonical ensemble - Phase space – Entropy - Connection between statistics and thermodynamics – Entropy of an ideal gas using the micro canonical ensemble - Entropy of mixing and Gibb's paradox.

UNIT –III CANONICAL AND GRAND CANONICAL ENSEMBLES (18 HRS.)

Trajectories and density of states - Liouville's theorem - Canonical and grand canonical ensembles - Partition function - Calculation of statistical quantities - Energy and density fluctuations.

UNIT –IV CLASSICAL AND QUANTUM STATISTICS (18 HRS.)

Density matrix - Statistics of ensembles - Statistics of indistinguishable particles - Maxwell-Boltzmann statistics - Fermi-Dirac statistics – Ideal Fermi gas – Degeneracy - Bose-Einstein statistics - Plank radiation formula - Ideal Bose gas - Bose-Einstein condensation.

UNIT –V REAL GAS,UISING MODEL AND FLUCTUATIONS (18 HRS.)

Cluster expansion for a classical gas - Virial equation of state – Calculation of the first Virial coefficient in the cluster expansion - Ising model - Mean-field theories of the Ising model in three, two and one dimensions - Exact solutions in one dimension. Correlation of space-time dependent fluctuations - Fluctuations and transport phenomena - Brownian motion - Langevin's theory - Fluctuation-dissipation theorem - The Fokker-Planck equation

UNIT VI DYNAMISM (Evaluation Pattern-CIA only)

Quantum Hall Effect

REFERENCES:

1. S. K. Sinha, 1990, Statistical *Mechanics*, Tata McGraw Hill, New Delhi.
2. B. K. Agarwal and M. Eisner, 1998, *Statistical Mechanics,* Second Edition New Age International, New Delhi.
3. J. K. Bhattacharjee, 1996, *Statistical Mechanics*: An Introductory Text, Allied Publication, New Delhi.
4. F. Reif, 1965, *Fundamentals of Statistical and Thermal Physics,* McGraw -Hill, New York.
5. M. K. Zemansky, 1968, *Heat and Thermodynamics,* 5th edition, McGraw-Hill New York.
6. Bhattacharjee, S***tatistical Mechanics*** Allied Publishers limited,(1996).

WEB REFERNCES :

1. https://www.cmi.ac.in/~kpnmurthy/StatisticalMechanics2017/book.pdf
2. https://www.britannica.com/science/degenerate-gas
3. https://www.space.com/23756-white-dwarf-stars.html
4. http://www.damtp.cam.ac.uk/user/tong/qhe.html
5. 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 PHASE TRANSITIONS				
1.1	Thermodynamic potentials	2	Chalk & Talk	PPT
1.2	Phase Equilibrium	3	Chalk & Talk	LCD
1.3	Gibb's phase rule	2	Lecture	Black Board
1.4	Phase transitions and Ehrenfest's classifications	3	Lecture	Black Board
1.5	Third law of Thermodynamics	3	Lecture	Black Board
1.6	Order parameters	3	Lecture	Black Board
1.7	Landau's theory of phase transition	2	Chalk & talk	Google classroom
UNIT -2 STATISTICAL MECHANICS AND THERMODYNAMICS				
2.1	Foundations of statistical mechanics	1	Lecture	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.2	Specification of states of a system	2	Chalk & Talk	Black Board
2.3	Micro canonical ensemble	3	Lecture	Black Board
2.4	Phase space	3	Lecture	Black Board
2.5	Entropy– Entropy of an ideal gas using the micro canonical ensemble	3	Chalk & Talk	PPT
2.6	Entropy of mixing and Gibb's paradox.	3	Chalk & Talk	PPT
2.7	Entropy of a system in contact with a heat reservoir	3	Chalk & Talk	PPT
UNIT - CANONICAL AND GRAND CANONICAL ENSEMBLES				
3.1	Trajectories and density of states	2	Lecture	Black Board
3.2	Liouville's theorem	3	Chalk & Talk	Black Board
3.3	Canonical and grand canonical ensembles	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.4	Partition function - Calculation of statistical quantities	3	Chalk & Talk	PPT
UNIT - 4 CLASSICAL AND QUANTUM STATISTICS				
4.1	Statistics of indistinguishable particles	3	Chalk & Talk	Black Board
4.2	Maxwell-Boltzmann statistics - Fermi-Dirac statistics – Ideal Fermi gas	3	Chalk & Talk	Black Board
4.3	Degeneracy - Bose-Einstein statistics	2	Chalk & Talk	Black Board
4.4	Plank radiation formula - Ideal Bose gas	3	Chalk & Talk	PPT
4.5	Bose-Einstein condensation.	3	Chalk & Talk	PPT
UNIT 5 REAL GAS,UISING MODEL AND FLUCTUATIONS				
5.1	Cluster expansion for a classical gas	3	Chalk & Talk	PPT
5.2	Virial equation of state – Calculation of the first Virial coefficient in the cluster expansion	4	Chalk & Talk	PPT
5.3	Ising model - Fluctuations and transport phenomena - Brownian motion	4	Chalk & Talk	PPT

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.4	Langevin's theory - Fluctuation-dissipation theorem	4	Chalk & Talk	PPT
5.5	The Fokker-Planck equation	3	Chalk & Talk	PPT
UNIT –6 DYNAMISM				
6.1	The Quantum Hall Effect		Chalk & Talk	PPT

EVALUATION PATTERN

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	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 School astic	-	-	-	-	-		5	5	12.5
Total	10	10	5	5	5	35	5	40	100

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

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 examine and elaborate the effect of changes in thermodynamic quantities on the states of matter during phase transition	K3	PSO1, PSO2,PSO3
CO 2	To analyze the macroscopic properties such as pressure, volume, temperature, specific heat, elastic moduli etc. using microscopic properties like intermolecular forces, chemical bonding, atomicity etc.	K4	PSO3
CO 3	Differentiate between canonical and grand canonical ensembles and to interpret the relation between thermodynamical quantities and partition function	K2	PSO4,PSO5
CO 4	To recall and apply the different statistical concepts to analyze the behaviour of ideal Fermi gas and ideal Bose gas and also to compare and distinguish between the three types of statistics.	K2,K5	PSO4,PSO5
CO 5	To discuss and examine the thermodynamical behaviour of gases under fluctuation and also using Ising model	K1,K2,K3	PSO2, PSO4

Mapping of C0s with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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 C0s with POs

CO/ PSO	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. Dr. I. Jeya Sheela

Forwarded By

HOD'S Signature & Name

Employability,
Skill Development
100%

I M.Sc.

SEMESTER –II

(*For those who joined in 2023 onwards*)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG2P5	Quantum Mechanics-I	Lecture	6 Hrs.	5

COURSE DESCRIPTION

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

COURSE OBJECTIVES

To develop the physical principles and the mathematical background important to quantummechanical descriptions. To describe the propagation of a particle in a simple, one-dimensional potential. To formulate and solve the Schrodinger's equation to obtain eigenvectors and energies forparticle in a three-dimensional potential. To explain the mathematical formalism and the significance of constants of motion, and seetheir relation to fundamental symmetries in nature. To discuss the Approximation methods like perturbation theory, Variational and WKBmethods for solving the Schrödinger equation.

UNITS

UNIT –IBASICFORMALISM: (18 HRS.)

Interpretation of the wave function – Time dependent Schrodinger equation– Time independent Schrodinger equation – Stationary states – Ehrenfest'stheorem – Linear vector space – Linear operator – Eigen functions and EigenValues – Hermitian Operator – Postulates of Quantum Mechanics –Simultaneous measurability of observables – General Uncertainty relation

UNIT –II ONE DIMENSIONAL AND THREE-DIMENSIONAL ENERGY EIGENVALUE PROBLEMS: (18 HRS.)

Square – well potential with rigid walls – Square well potential with finitewalls – Square potential barrier – Alpha emission – Bloch waves in a periodic potential – Kronig-penny square – well periodic potential – Linear harmonic oscillator: Operator method – Particle moving in a spherically symmetric potential – System of two interacting particles – Hydrogen atom – Rigid rotator

UNIT –III : GENERALFORMALISM (18 HRS.)

Dirac notation – Equations of motions – Schrodinger representation – Heisenberg representation – Interaction representation – Coordinate representation – Momentum representation – Symmetries and conservation laws – Unitary transformation – Parity and time reversal

UNIT–IV APPROXIMATION METHODS (18HRS.)

Time independent perturbation theory for non-degenerate energy levels – Degenerate energy levels – Stark effect in Hydrogen atom – Ground and excited state – Variation method – Helium atom – WKB approximation – Connection formulae (no derivation) – WKB quantization – Application to simple harmonic oscillator.

UNIT –V ANGULAR MOMENTUM (18HRS.)

Eigenvalue spectrum of general angular momentum – Ladder operators andtheir algebra – Matrix representation – Spin angular momentum – Additionof angular momenta – CG Coefficients – Symmetry and anti –

symmetry ofwave functions – Construction of wave-functions and Pauli's exclusionprinciple.

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 BOOKS:

1. P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics, 2 nd edition(37th Reprint),Tata McGraw-Hill, New Delhi, 2010.
2. G. Aruldhas, Quantum Mechanics, 2nd edition, Prentice Hall of India, New Delhi, 2009.
3. David J Griffiths, Introduction to Quantum Mechanics. 4th edition, Pearson, 2011.
4. SL Gupta and ID Gupta, Advanced Quantum Theory and Fields, 1 st Edition, S.Chand& Co., New Delhi, 1982.
5. A. Ghatak and S. Lokanathan, Quantum Mechanics: Theory and Applications, 4 th Edition, Macmillan, India, 1984.

REFERENCEBOOKS

1. E. Merzbacher, Quantum Mechanics, 2nd Edition, John Wiley and Sons, New York, 1970.
2. V. K. Thankappan, Quantum Mechanics, 2nd Edition, Wiley Eastern Ltd, New Delhi, 1985.
3. L. D. Landau and E. M. Lifshitz, Quantum Mechanics, 1st edition, Pergomon Press, Oxford, 1976.
4. S. N. Biswas, Quantum Mechanics, Books and Allied Ltd., Kolkata, 1999.
5. V. Devanathan, Quantum Mechanics, 2nd edition, Alpha Science International Ltd, Oxford , 2011.

WEB SOURCES

1. http://research.chem.psu.edu/lxjgroup/download_files/chem565-c7.pdf
2. http://www.feynmanlectures.caltech.edu/III_20.html
3. http://web.mit.edu/8.05/handouts/jaffe1.pdf
4. https://hepwww.pp.rl.ac.uk/users/haywood/Group_Theory_Lectures/Lecture_ 1.pdf
5. https://theory.physics.manchester.ac.uk/~xian/qm/chapter3.pdf

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 :BASIC FORMALISM				
1.1	Interpretation of the wave function – Time dependent Schrodinger equation	3	Chalk & Talk	Black Board
1.2	Time independent Schrodinger equation – Stationary states –	3	Chalk & Talk	Black Board
1.3	Ehrenfest'stheorem	3	Chalk & Talk	Black Board
1.4	Linear vector space – Linear operator – Eigen functions and Eigen Values	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.5	Hermitian Operator – Postulates of Quantum Mechanics	3	Chalk & Talk	Black Board
1.6	Simultaneous measurability of observables – General Uncertainty relation	3	Chalk & Talk	Black Board
UNIT -2 ONEDIMENSIONALAND THREE-DIMENSIONALENERGY EIGENVALUEPROBLEMS:				
2.1	Square – well potential with rigid walls – Square well potential with finite walls – Square potential barrier	2	Chalk & Talk	Black Board
2.2	Alpha emission – Bloch waves in aperiodic potential	2	Chalk & Talk	Black Board
2.3	Kronig-penny square – well periodic potential	3	Chalk & Talk	Black Board
2.4	Linear harmonic oscillator: Operator method	2	Chalk & Talk	Black Board
2.5	Particle moving in a spherically symmetric potential	2	Chalk & Talk	Black Board
2.6	System of two interacting particles	2	Chalk & Talk	Black Board
2.7	Hydrogen atom	3	Chalk & Talk	Black Board
2.8	Rigid rotator	2	Chalk & Talk	Black Board
UNIT -3 GENERALFORMALISM:				
3.1	Dirac notation – Equations of motions	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.2	Schrodinger representation - Heisenberg representation	4	Chalk & Talk	Black Board
3.3	Interaction representation – Coordinate representation	4	Chalk & Talk	Black Board
3.4	Momentum representation – Symmetries and conservation laws	3	Chalk & Talk	Black Board
3.5	Unitary transformation – Parity and time reversal	4	Chalk & Talk	Black Board
UNIT -4 APPROXIMATION METHODS				
4.1	Time independent perturbation theory for non-degenerate energy levels	3	Chalk & Talk	Black Board
4.2	Degenerate energy levels –	3	Chalk & Talk	Black Board
4.3	Stark effect in Hydrogen atom – Ground and excited state	3	Chalk & Talk	Black Board
4.4	Variation method – Helium atom	3	Chalk & Talk	Black Board
4.5	WKB approximation Connection formulae (no derivation)	3	Chalk & Talk	Black Board
4.6	WKB quantization – Application tosimple harmonic oscillator	3	Chalk & Talk	Black Board
UNIT -5 ANGULAR MOMENTUM				
5.1	Eigenvalue spectrum of general angular momentum –	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.2	Ladder operators and their algebra – Matrix representation	3	Chalk & Talk	Black Board
5.3	Spin angular momentum – Addition of angular momenta	3	Chalk & Talk	Black Board
5.4	CG Coefficients	3	Chalk & Talk	Black Board
5.5	Symmetry and anti – symmetry of wave functions	3	Chalk & Talk	Black Board
5.6	Construction of wave-functions and Pauli's exclusion principle	3	Chalk & Talk	Black Board

EVALUATION PATTERN

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	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

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**

The best out of two will be taken into account

			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	Demonstrates a clear understanding of the basic postulates of quantummechanics which serve to formalize the rules of quantum mechanics	K1, K5	PSO1, PSO2, PSO3
CO 2	able to apply and analyze the Schrodinger equation to solve one dimensionalproblems and three dimensional problems	K3, K4	PSO1, PSO2, PSO3
CO 3	Can discuss the various representations, space time symmetries andformulations of time evolution	K1	PSO1, PSO2, PSO3, PSO5
CO 4	Can formulate and analyze the approximation methods for various quantummechanical problems	K4,K5	PSO1, PSO2, PSO3, PSO5
CO 5	To apply non-commutative algebra for topics such as angular and spin angularmomentum and hence explain spectral line splitting	K3 , K4	PSO1, PSO2, PSO3, PSO5

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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/ PSO	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:

Dr. M.V. Leena Chandra

Forwarded By

Dr. A. Sheela Vimala Rani

HoD'S Signature & Name

Employability,
Skill Development
100%

I PG

SEMESTER –II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PAPH	23PG2P6	PRACTICAL II	Practical	6	4

COURSE DESCRIPTION

The course provides hands on training to work with fiber, Laser and young's modulus, AC bridges, Flip – Flop, and OP-AMP circuits.

COURSE OBJECTIVE/S

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

(Minimum of Twelve Experiments from the list)

1. Determination of Young's modulus and Poisson's ratio by Elliptical fringes - Cornu's Method
2. Determination of Stefan's constant of radiation from a hot body
3. Measurement of Susceptibility of liquid - Quincke's method
4. B-H curve using CRO
5. Thickness of LG Plate
6. Arc spectrum: Copper
7. Determination of e/m - Millikan's method
8. Miscibility measurements using ultrasonic diffraction method
9. Determination of Thickness of thin film. - Michelson Interferometer
10. Iodine absorption spectra
11. Determination of Numerical Apertures and Acceptance angle of optical fibers using Laser Source.
12. Measurement of Dielectricity - Microwave test bench
13. Hall Effect in Semiconductor. Determine the Hall coefficient, carrier concentration and carrier mobility
14. Interpretation of vibrational spectra of a given material
15. Determination of I-V Characteristics and efficiency of solar cell
16. GM counter – Absorption coefficient – Maximum range of β rays
17. IC 7490 as scalar and seven segment display using IC7447
18. Solving simultaneous equations – IC 741 / IC LM324

19. Op-Amp –Active filters: Low pass, High pass and Band pass filters (Second Order) Batter worth filter
20. Construction of Current to Voltage and Voltage to Current Conversion using IC 741.
21. Construction of second order butterworth multiple feedback narrow band pass filter
22. Realization of analog to digital converter (ADC) using 4-bit DAC and synchronous counter IC74193
23. Construction of Schmidt trigger circuit using IC555 for a given hysteresis – Application as squarer
24. Construction of pulse generator using the IC 555 – Application as frequency divider
25. BCD to Excess- 3 and Excess 3 to BCD code conversion
26. Study of binary up / down counters - IC 7476 / IC7473
27. Shift register and Ring counter and Johnson counter- IC 7476/IC 7474

TEXT BOOKS

1. Practical Physics, Gupta and Kumar, PragatiPrakasan
2. Kit Developed for doing experiments in Physics- Instruction manual, R.Srinivasan K.R Priolkar, Indian Academy of Sciences
3. Op-Amp and linear integrated circuit, Ramakanth A Gaykwad, Eastern Economy Edition.
4. Electronic lab manual Vol I, K ANavas, Rajath Publishing
5. Electronic lab manual Vol II, K ANavas, PHI eastern Economy Edition

REFERENCE BOOKS

1. An advanced course in Practical Physics, D.Chattopadhayay, C.RRakshit, New Central Book Agency Pvt. Ltd
2. Advanced Practical Physics, S.P Singh, PragatiPrakasan
3. A course on experiment with He-Ne Laser, R.S. Sirohi, John Wiley & Sons (Asia) Pvt.ltd
4. Electronic lab manual Vol II, Kuriachan T.D, Syam Mohan, Ayodhya Publishing
5. Electronic Laboratory Primer a design approach, S. Poornachandra, B.Sasikala, Wheeler Publishing, New Delhi

Employability,
Skill Development
100%

I M.Sc. PHYSICS

SEMESTER –II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG2PE5	ADVANCED MATHEMATICAL PHYSICS	Elective	4 Hrs.	3

COURSE DESCRIPTION

This course emphasise the basic concepts and applications of Mathematical Physics which involves Tensors, Special functions and group theory.

COURSE OBJECTIVES

This course provides the foundation in conceptual understanding of Tensors, Special functions and group theory, required for the description of its applications in the physical phenomena

UNIT –I TENSOR ANALYSIS (12 HRS.)

Cartesian vectors and tensors illustration with moment of inertia, conductivity, dielectric tensors. Illustration from physics. Vectors and tensors under general co-ordinate transformations, contravariant and covariant vectors and tensors, mixed tensors; tensor algebra, addition, subtraction, direct product of tensors, quotient theorem, symmetric and antisymmetric tensors-Fundamental Tensors

UNIT – II SPECIAL FUNCTIONS I (12 HRS.)

Legendre's differential equation and Legendre functions, Generating function-Rodrigue formula-Orthogonal properties-Recurrence formula

UNIT –III SPECIAL FUNCTIONS II (12 HRS.)

Bessel differential equations-Bessel functions of the first kind-recurrence formula-generating function-Hermite Polynomials-Generating function

UNIT –IV ABSTRACT GROUP THEORY (12 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 – 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 –V THEORY OF GROUP REPRESENTATION: (12 HRS.)

Representations of groups – the great Orthogonalitytheorem 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)

Solving application problems on Group theory and special functions

TEXT BOOKS:

1. A.W.Joshi, Group Theory for Physicists
2. Matrices and Tensors in Physics by A.W. Joshi-Wiley Eastern Ltd
3. Mathematical Physics with classical mechanics by Satya Prakash SultanChand and Sons, Fourth Revised and enlarged edition 2002
4. D.B.Lichtenberg, Unitary Symmetry and Elementary Particles
5. E.Butkov, Mathematical Physics
6. J.V.Narlikar, General Relativity & Cosmology
7. R. Geroch, Mathematical Physics, The University of Chicago press (1985).
8. Chemical Applications of group theory by F. Albert Cotton – II ed. Wiley Eastern Ltd.

BOOKS FOR REFERENCES:

1. M.Hamermesh *Group Theory*

2. M.E.Rose: Elementary Theory of Angular Momentum

3. Georgi : Lie Groups for Physicists

4. E.A.Lord: Tensors, Relativity & Cosmology

5. P. Szekeres, A course in modern mathematical physics: Groups, Hilbert spaces and differential geometry, Cambridge University Press.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 Tensor Analysis				
1.1	Cartesian vectors and tensors illustration with moment of inertia, conductivity, dielectric tensors. Illustration from physics	3	Chalk & Talk	Black Board
1.2	Vectors and tensors under general co-ordinate transformations, contravariant and covariant vectors	3	Chalk & Talk	Black Board
1.3	mixed tensors; tensor algebra, addition, subtraction, direct product of tensors, quotient theorem, symmetric and antisymmetric tensors-	3	Lecture	Black Board
1.4	Fundamental Tensorscoordinates	3	Lecture	Black Board
UNIT -2 SPECIAL FUNCTIONS I				
2.1	Legendre's differential equation and	2	Chalk& Talk	Black Board

2.2	Legendre functions	2	Chalk& Talk	Black Board
2.3	Generating function	2	Lecture	Black Board
2.4	Rodrigue formula	2	Lecture	Black Board
2.5	Orthogonal properties	2	Chalk& Talk	Black Board
2.6	Recurrence formula	2	Chalk& Talk	Black Board
UNIT - 3 Special Functions II				
3.1	Bessel differential equations	2	Chalk & Talk	Blac k Boar d
3.2	Bessel functions of the first kind	2	Chalk & Talk	Blac k Boar d
3.3	Recurrence formula	2	Chalk & Talk	Blac k Boar d
3.4	Generating function	3	Chalk & Talk	Blac k Boar d
3.5	Hermite Polynomials & Generating functions	3	Chalk & Talk	Blac k Boar d
UNIT – 4 ABSTRACT GROUP THEORY				
4.1	Defining properties of a group –	2	Chalk &	Black

	some examples of groups		Talk	Board
4.2	Subgroups – classes	1	Chalk & Talk	Black Board
4.3	Molecular symmetry and the symmetry groups – symmetry elements and operations	1	Chalk & Talk	Black Board
4.4	Symmetry planes and reflections – the inversion centre – proper axes	2	Lecture	PPT
4.5	proper rotations – improper axes and improper rotations	2	Lecture	PPT
4.6	The symmetry point groups – symmetries with multiple higher order axes	2	Chalk & Talk	Black Board
4.7	A systematic procedure for symmetry classification of molecules – illustrative examples – classes of symmetry operations	2	Chalk & Talk	Black Board
UNIT 5 - THEORY OF GROUP REPRESETATION				
5.1	Representations of groups – the great Orthogonalitytheorem and its consequences	3	Chalk & Talk	Black Board
5.2	character tables	2	Chalk & Talk	Black Board
5.3	representations for cyclic groups	2	Chalk & Talk	Black Board
5.4	Wave functions as bases for irreducible representation	3	Chalk & Talk	Black Board
5.5	The direct product	2	Chalk & Talk	Black Board

EVALUATION PATTERN

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assess Ment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks	Assignment 5 Mks	OBT/PPT 5 Mks	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

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	Define and Deduce illustrations in Physics as Tensors	K1	PSO1& PSO2
CO 2	Discuss Legendre functions and recurrence formula	K1, K2,	PSO3
CO 3	Explain Bessel and Hermite functions	K2 & K4	PSO5
CO 4	Describe group, cyclic group , sub group and multiplication tables	K2, K3	PSO4& PSO5
CO5	Prove great orthogonality theorem and construct character tables of a	K2,K3	PSO4& PSO5

	group		

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/ PSO	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. M.Ragam

2. Ms. J. R. Sofia

Forwarded By

Dr. A. SheelaVimala Rani

HoD'S Signature & Name

Employability,
Skill Development
100%

I PG

SEMESTER –II

(*For those who joined in 2023 onwards*)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG2PE6	NONLINEAR DYNAMICS	Lecture	4 Hrs.	3

COURSE DESCRIPTION

This course introduces Basics of Numerical methods and Differential equations, Fundamentals of linear and nonlinear waves, and Basics of communication systems

COURSE OBJECTIVES

To enable the student to understand the analytical and numerical techniques of nonlinear dynamics, concepts of various coherent structures, bifurcations and onset of chaos, theory of chaos and its characterization and applications of solitons, chaos and fractals

UNITS

UNIT –I : GENERAL (12 HRS.)

Linear waves-ordinary differential equations(ODEs)-Partial differential equations(PDEs)- Methods to solve ODEs and PDEs.- Numerical methods – Linear and Nonlinear oscillators-Nonlinear waves-Qualitative features

UNIT –II : COHERENT STRUCTURES (12 HRS.)

Linear and Nonlinear dispersive waves - Solitons – KdB equation – Basic theory of KdB equation –Ubiquitous soliton equations – AKNS Method, Backlund transformation, Hirotabilinearization method, Painleve analysis - Perturbation methods- Solitons in Optical fibres - Applications.

UNIT –III : BIFURCATIONS AND ONSET OF CHAOS (12 HRS.)

One dimensional flows – Two dimensional flows – Phase plane – Limit cycles – Simple bifurcations – Discrete Dinamical system – Strange attractors – Routes to chaos.

UNIT–IV : FRACTALS AND CELLULAR AUTOMATA (12 HRS.)

Self similarity - Properties and examples of fractals- Fractal dimension-Construction and properties of some fractals-Middle one third cantor set-Koch curve-Sierpinski triangle-Julia setMandelbrot set-Applications of fractals-Cellular Automata-Fractal Structure- Applications.

UNIT –V : APPLICATIONS (12 HRS.)

Soliton based communication systems – Solition based computation – Synchronization of chaos – Chaos based communication – Cryptography – Image processing – Stochastic – Resonance – Chaos based computation – Time Series analysis.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Applications of solitons in daily life

TEXT BOOK:

1. M.Lakshmanan and S.Rajasekar, Nonlinear Dynamics: Integrability, Chaos and Patterns.Springer, 2003.
2. A.Hasegawa and Y.Kodama, Solitons in Optical Communications. Oxford Press, 1995.
3. Drazin, P. G. Nonlinear Systems. Cambridge University Press, 2012. ISBN: 9781139172455.
4. Wiggins, S. Introduction to Applied Nonlinear Dynamical Systems and Chaos. Springer, 2003. ISBN: 9780387001777.
5. Strogatz, Steven H. Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering. Westview Press, 2014. ISBN: 9780813349107.

REFERENCES:

1. G.Drazin and R.S.Johnson. Solitons: An Introduction. Cambridge University Press, 1989.
2. M.Lakshmanan and K.Murali. Chaos in Nonlinear Oscillators. World Scientific, 1989.
3. S.Strogatz**.** Nonlinear Dynamics and Chaos. Addison Wesley, 1995.
4. Hao Bai-Lin, Chaos (World Scientidic, Singapore, 1984).

5. Kahn, P. B., Mathematical Methods for Scientists & Engineers (Wiley, NY, 1990)

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 GENERAL				
1.1	Introduction & Linear waves	2	Chalk & Talk	Black Board
1.2	ordinary differential equations(ODEs)-	2	Chalk & Talk	Black Board
1.3	Partial differential equations(PDEs)	2	Chalk & Talk	Black Board
1.4	Methods to solve ODEs and PDEs	2	Chalk & Talk	Black Board
1.5	Numerical methods – Linear and Nonlinear oscillators	3	Chalk & Talk	Black Board
1.6	Nonlinear waves	2	Chalk & Talk	Black Board
1.7	Qualitative features	2	Chalk & Talk	Black Board
UNIT -2 DYNAMICAL SYSTEMS				
2.1	Introduction: examples of dynamical systems	3	Chalk & Talk	Black Board
2.2	driven damped pendulum	2	Chalk & Talk	Black Board
2.3	ballon oscillating floor & dripping faucet	2	Chalk & Talk	Black Board
2.4	chaotic electrical circuits &One-dimensional maps	2	Chalk & Talk	Black Board
2.5	The logistic map &bifurcations	2	Chalk &	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	in the logistic map		Talk	Board
2.6	fixed points and their stability	2	Chalk & Talk	Black Board
2.7	other one-dimensional maps	2	Chalk & Talk	Black Board
UNIT -3 BIFURCATIONS AND ONSET OF CHAOS				
3.1	Introduction & One dimensional flow	3	Chalk & Talk	Black Board
3.2	Two dimensional flows	2	Chalk & Talk	Black Board
3.3	Phase plane – Limit cycles	2	Chalk & Talk	Black Board
3.4	Simple bifurcations	2	Chalk & Talk	Black Board
3.5	Discrete Dinamical system	2	Chalk & Talk	Black Board
3.6	Strange attractors	2	Chalk & Talk	Black Board
3.7	Routes to chaos	2	Chalk & Talk	Black Board
UNIT -4 COHERENT STRUCTURES				
4.1	Linear and Nonlinear dispersive waves	2	Chalk & Talk	Black Board
4.2	KdB equation& Basic theory of KdB equation	2	Chalk & Talk	Black Board
4.3	Solitons & Ubiquitous soliton equations	2	Chalk & Talk	Black Board
4.4	AKNS Method & Backlund transformation	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.5	Hirotabilinearization method	2	Chalk & Talk	Black Board
4.6	Painleve analysis & Perturbation methods	2	Chalk & Talk	Black Board
4.7	Solitons in Optical fibres	2	Chalk & Talk	Black Board
4.8	Applications	1	Chalk & Talk	Black Board
UNIT -5 APPLICATIONS				
5.1	Introduction & Soliton based communication systems	2	Chalk & Talk	Black Board
5.2	Solition based computation	2	Chalk & Talk	Black Board
5.3	Synchronization of chaos	2	Chalk & Talk	Black Board
5.4	Chaos based communication	2	Chalk & Talk	Black Board
5.5	Cryptography & Image processing	2	Chalk & Talk	Black Board
5.6.	Stochastic &Resonance	2	Chalk & Talk	Black Board
5.7	Chaos based computation & Time Series analysis	3	Chalk & Talk	Black Board

EVALUATION PATTERN

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assess Ment

	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks	Assignment 5 Mks	OBT/PPT 5 Mks	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

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 analyze the numerical techniques of nonlinear dynamics	K2	PSO1, PSO2, PSO3
CO 2	To Understand various dynamical systems	K2	PSO1, PSO2,
CO 3	To explain the bifurcations and onset of chaos	K3	PSO2, PSO3, PSO5
CO 4	To understand the concepts of various coherent structures	K2, K3	PSO1, PSO2, PSO3, PSO5
CO 5	To describe the applications of solitons, chaos and fractals	K3 & K4	PSO2, PSO3, PSO5

Mapping of COs with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PS O5

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

Mapping of COs with POs

CO/ PSO	**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:

Dr. R.Jothi Mani

Forwarded By

Dr. A. Sheela Vimala Rani

HoD'S Signature & Name

Employability,
Skill Development
100%

I M.Sc.PHYSICS

SEMESTER –II

(For those who joined in 2023 onwards)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG2PE7	8086 MICROPROCESSOR AND MICROCONTROLLER 8051	Theory	4	3

COURSE DESCRIPTION

This course aims at providing the students with an exposure to the popular microprocessor Intel 8086 and the microcontroller Intel 8051

COURSE OBJECTIVES

- To provide an understanding of the architecture and functioning of microprocessor 8086 and to the methods of interfacing I/O devices and memory to microprocessor
- To introduce 8086 programming and instruction sets of microcontroller 8051

Unit I: 16 BIT MICROPROCESSORS (14 Hrs)

Intel 8086 – Pin description of Intel 8086 – operation modes of 8086 – pin description for minimum mode- pin description for maximum mode – Register organization of 8086 – Bus interface and execution Unit (BIU and EU)- 8086 read and write bus cycles- lock – Addressing modes of 8086

Unit II:8086-INSTRUCTION SET & ASSEMBLY LANGUAGE PROGRAMMES (14 Hrs)

8086 Instruction groups – Addressing mode byte – Segment register – selection – segment override – 8086 instructions.

Assembly Language Programmes – To find the largest number in a data array – To find the smallest number in a data array – To arrange numbers in ascending (or descending) order – Block move or relocation – Sum of a series of 16 – Bit numbers whose sum is 16 – Bit or 32 – Bit – multibyte addition.

Unit III: INTERFACING OF A/D CONVERTER THROUGH PROGRAMMABLE PERIPHERAL INTERFACE (INTEL 8255) (12 Hrs)

Programmable Peripheral Interface – Operating modes of 8255- bit set – reset – feature- control groups- control word with examples – Handshake signals for an input in Modes 1 and 2- Interfacing of ADC 0808 or 0809 to 8086.

Unit IV : INTEL 386 AND 486 μP, AND PENTIUM (10 Hrs)

Intel 386, 486 μP- 486 Dx Architecture- Memory Organization – Operation modes- Protection – Interrupts and exception – Pentium μP –- On – chip separate cache memory for code and data.

Unit V:THE 8051 MICROCONTROLLERS & 8051 ASSEMBLY LANGUAGE PROGRAMMING (10 Hrs)

Microcontrollers and Embedded Processors – Overview of 8051 Family.

Inside the 8051 – Introduction to 8051 Assembly Programming – Assembling and Running an 8051 Program(simple programs only)

UNIT –VI PROFESSIONAL COMPONENTS

Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism

TEXT BOOK

1. Advanced microprocessors and interfacing – Badri Ram
2. The 8051 Microcontroller and Embedded systems - Muhammad Ali Mazidi, Janice Gillipsie Mazidi- Pearson Prentice Hall, First Impression, 2004

BOOKS FOR REFERENCE

1. The Intel Microprocessors 8086/8088, 80186, 80286, 80386 and 80486, Prentice Hall of India, New Delhi, third edition, 1995 - - Barry B. Brey
2. Advanced Microprocessors – Daniel Tabak
3. Microprocessor interfacing, Programming and Hardware, Tata McGraw Hill 2005. Douglas V. Hall
4. Fundamentals of Microprocessor 8086 , S. Visvanathan PVT., Ltd., 3 rd Edition 2005 - Vijayendran V.

WEB SOURCES

1. https://www.tutorialspoint.com/microprocessor/microprocessor8086_architecture.html
2. http://www.electronicsengineering.nbcafe.in/peripheral-mapped-io-interfacing/
3. https://www.geeksforgeeks.org/programmable-peripheral-interface-8255/
4. http://www.circuitstoday.com/8051-microcontrollerhttps://www.elprocus.com/8051-assembly-language-programming/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 16 BIT MICROPROCESSORS				
1.1	Introduction: Intel 8086,Pin description of Intel 8086	2	Chalk & Talk	Black Board
1.2	Operation modes of 8086, pin description for minimum mode, pin description for maximum mode	3	Chalk & Talk	Black Board
1.3	Register organization of 8086	3	Chalk & Talk	Black Board
1.4	Bus interface and execution Unit (BIU and EU), 8086 read and write bus cycles,	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	lock			
1.5	Addressing modes of 8086	3	Chalk &Talk	Black Board
UNIT -2 8086-INSTRUCTION SET & ASSEMBLY LANGUAGE PROGRAMMES				
2.1	8086 Instruction groups, Addressing mode	2	Chalk & Talk	Black Board
2.2	Segment register, selection, segment override, 8086 instructions	2	Chalk & Talk	Black Board
2.3	Assembly Language Programmes, To find the largest number in a data array, To find the smallest number in a data array	2	Chalk & Talk	Black Board
2.4	To arrange numbers in ascending (or descending) order	2	Chalk & Talk	Black Board
2.5	Block move or relocation	2	Lecture	LCD
2.6	Sum of a series of 16, Bit numbers whose sum is 16	2	Chalk & Talk	Black Board
2.7	Bit or 32, Bit, multibyte addition	2	Lecture	Black Board
UNIT -3 INTERFACING OF A/D CONVERTER THROUGH PROGRAMMABLE PERIPHERAL INTERFACE (INTEL 8255)				
3.1	Programmable Peripheral Interface	3	Chalk & Talk	Black Board
3.2	Operating modes of 8255	3	Chalk & Talk	Black Board
3.3	Bit set, reset, feature, control groups, control	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	word with examples			
3.4	Handshake signals for an input in Modes 1 and 2	2	Chalk & Talk	Black Board
3.5	Interfacing of ADC 0808 or 0809 to 8086	2	Chalk & Talk	Black Board
UNIT -4INTEL 386 AND 486 μP, AND PENTIUM				
4.1	Intel 386, 486 μP- 486 Dx Architecture	2	Lecture	Black Board
4.2	Memory Organization	2	Lecture	LCD
4.3	Operation modes	1	Chalk & Talk	Black Board
4.4	Protection – Interrupts and exception	2	Lecture	LCD
4.5	Pentium μP	1	Chalk & Talk	Black Board
4.6	On – chip separate cache memory for code and data	2	Chalk & Talk	Black Board
UNIT -5 THE 8051 MICROCONTROLLERS & 8051 ASSEMBLY LANGUAGE PROGRAMMING				
5.1	Microcontrollers and Embedded Processors	2	Chalk & Talk	Black Board
5.2	Overview of 8051 Family	2	Chalk & Talk	Black Board
5.3	Inside the 8051	2	Chalk & Talk	Black Board
5.4	Introduction to 8051 Assembly Programming	2	Chalk & Talk	Black Board
5.5	Assembling and Running an 8051 Program(simple	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	programs only)			

CIA

Scholastic	**23**
Non Scholastic	**2**
	25

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
15		3	5	2	25	75	100

• PG CIA Components					
			Nos		
C1	-	Test (CIA 1)**	1	-	15 Mks
C2	-	Test (CIA 2)**	1	-	
C3	-	Assignment	2 *	-	3Mks
C4	-	Seminar	1	-	5 Mks
C5	-	Attendance		-	2 Mks

The best out of two will be taken into account

*** Average of C1 and C2 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
CO1	Gain knowledge of architecture and working of 8086 microprocessor.	K1	PSO1,PSO2& PSO3
CO2	write simple assembly language programs for 8086 microprocessor	K3	PSO5
CO3	Learn about various techniques Of Interfacing A/D Converter Through Intel 8255.	K1, K3	PSO2,PSO3
CO4	Gain knowledge of Intel 386 And 486 μP, And Pentium Processors.	K2	PSO4,PSO5
CO5	write simple assembly language programs for 8051 Microcontroller	K1, K4	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

Employability,
Skill Development
100%

I MSC PHYSICS

SEMESTER –I

(*For those who joined in 2023 onwards*)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG2PE8	Biophysics	Lecture	4 Hrs.	3

COURSE DESCRIPTION

This course introduces fundamental concepts of Physics and Biology.

COURSE OBJECTIVES

To understand the physical principles involved in cell function maintenance; to enable the students to understand the fundamentals of macromolecular structures involved in propagation of life; to have knowledge about the biophysical function of membrane and neuron; to understand various kinds of radiation and their effects on living system and to know the hazards posed by such radiations and the required precautions; to enable the students to understand the physical principles behind the various techniques available for interrogating biological macromolecules.

UNITS

UNIT –I :CELLULAR BIOPHYSICS: (12 HRS.)

Architecture and Life Cycle of cells – Organelles of Prokaryotic and Eukaryotic cell – Cell size and shape – Fine structure of Prokaryotic and Eukaryotic cell organization – Compartment & assemblies membrane system – Extracellular matrix - Molecular mechanisms of Vesicular traffic - Electrical activities of cardiac and neuronal cells.

UNIT –II MOLECULAR BIOPHYSICS: (12 HRS.)

Macromolecular structure: Protein structure – amino acids, peptide bonds, primary, secondary, tertiary and quaternary structures of proteins

Nucleic acid structure: nucleosides and nucleotides, RNA structure, DNA structure and conformation.

Special Bio-macromolecules: Metalloproteins, nucleoproteins, ribozymes, chaperons and prions.

UNIT –III MEMBRANE AND NEURO BIOPHYISCS: (12HRS.)

Models membranes - Biological membranes and dynamics – Membrane Capacitors – Transport across cell and organelle membranes – Ion channels.

Nervous system: Organization of the nervous system –Membrane potential – Origins of membrane potential - Electrochemical potentials – Nernst equation – Goldman equation.

UNIT–IV RADIATION BIO PHYSICS: (12HRS.)

X-Ray: Effects on bio-macromolecules – Gamma Radiation: Molecular effects of gamma radiation, Radiation effects on nucleic acids and membranes, Effects on cell and organelles – UV radiation: Effects on bio-macromolecules and proteins – Radiation hazards and protection – use of radiations in cancer.

UNIT –V PHYSICAL METHODS IN BIOLOGY: (12HRS.)

Spectroscopy: UV-Visible absorption spectrophotometry – Optical Rotatory Dispersion (ORD) – Structure Determination: X-ray Crystallography, Electron spin resonance (ESR) and biological applications. Chromatography: Thin layer chromatography (TLC), Gas liquid chromatography (GLC) – Centrifugation: Differential centrifugation, density gradient centrifugation. Electrophoresis: Gel electrophoresis, polyacrylamide gel electrophoresis.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Biophysics applies the principles of physics and chemistry and the methods of mathematical analysis and computer modeling to biological systems in explaining the fundamental level the structure, dynamics, interactions and ultimate function of biological systems.

TEXT BOOK:

1. The cell: A molecular approach, Geoffrey M. Cooper, ASM Press, 2013.
2. Biophysics, VasanthaPattabhi, N. Gautham, Narosa Publishing, 2009

3. Biophysics, P. S. Mishra VK Enterprises, 2010.
4. Biophysics, M. A Subramanian, MJP Publishers, 2005.
5. Bioinstrumentation, L. Veerakumari, MJP Publishers, 2006.

REFERENCES:

1. Chemical Biophysics by Daniel A Beard (Cambridge University Press, 2008).
2. Essential cell biology by Bruce Albert et al (Garland Science)
3. Biophysics, W. Hoppe, W. Lohmann, H. Markl and H. Ziegler. Springer Verlag, Berlin (1983).
4. Membrane Biophysics by Mohammad Ashrafuzzaman, Jack A. Tuszynski, (Springer science & business media).
5. Biological spectroscopyby Iain D. Campbell, Raymond A. Dwek

WEB SOURCES

1. General Bio:http://www.biology.arizona.edu/DEFAULT.html
2. Spectroscopy: http://www.cis.rit.edu/htbooks/nmr/inside.htm
3. Electrophoresis:http://learn.genetics.utah.edu/content/labs/gel/
4. Online biophysics programs: http://mw.concord.org/modeler/
5. https://blanco.biomol.uci.edu/WWWResources.html

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 CELLULAR BIOPHYSICS				
1.1	Architecture and Life Cycle of cells, Organelles of Prokaryotic and Eukaryotic cell	2	Chalk & Talk	Black Board
1.2	Cell size and shape	1	Chalk & Talk	Black Board
1.3	Fine structure of Prokaryotic and Eukaryotic cell organization	2	Chalk & Talk	Black Board
1.4	Compartment & assemblies membrane system	2	Chalk & Talk	Black Board
1.5	Extracellular matrix	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.6	Molecular mechanisms of Vesicular traffic	2	Chalk & Talk	Black Board
1.7	Electrical activities of cardiac and neuronal cells.	1	Chalk & Talk	Black Board
UNIT -2 MOLECULAR BIOPHYSICS				
2.1	Macromolecular structure: Protein structure	2	Chalk & Talk	Black Board
2.2	amino acids, peptide bonds, primary, secondary, tertiary and quaternary structures of proteins	2	Chalk & Talk	Black Board
2.3	Nucleic acid structure: nucleosides and nucleotides	2	Chalk & Talk	Black Board
2.4	RNA structure, DNA structure and conformation	2	Chalk & Talk	Black Board
2.5	Special Bio-macromolecules	2	Chalk & Talk	Black Board
2.6	Metalloproteins, nucleoproteins	1	Chalk & Talk	Black Board
2.7	ribozymes, chaperons and prions	1	Chalk & Talk	Black Board
UNIT -3 MEMBRANE AND NEURO BIOPHYISCS				
3.1	Models membranes - Biological membranes and dynamics	2	Chalk & Talk	Black Board
3.2	Membrane Capacitors – Transport across cell and organelle membranes – Ion channels.	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.3	Nervous system: Organization of the nervous system –Membrane potential	3	Chalk & Talk	Black Board
3.4	Origins of membrane potential - Electrochemical potentials	3	Chalk & Talk	Black Board
3.5	Nernst equation – Goldman equation	2	Chalk & Talk	Black Board
UNIT -4 RADIATION BIO PHYSICS				
4.1	X-Ray: Effects on bio-macromolecules	2	Chalk & Talk	Black Board
4.2	Gamma Radiation: Molecular effects of gamma radiation, Radiation effects on nucleic acids and membranes	2	Chalk & Talk	Black Board
4.3	Radiation effects on nucleic acids and membranes	2	Chalk & Talk	Black Board
4.4	Effects on cell and organelles – UV radiation	2	Chalk & Talk	Black Board
4.5	Effects on bio-macromolecules and proteins – Radiation hazards and protection	2	Chalk & Talk	Black Board
4.6	use of radiations in cancer	2	Chalk & Talk	Black Board
UNIT -5 PHYSICAL METHODS IN BIOLOGY				
5.1	Spectroscopy: UV-Visible absorption spectrophotometry – Optical Rotatory Dispersion (ORD) – Structure Determination	3	Chalk & Talk	Black Board
5.2	X-ray Crystallography	2	Chalk &	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
			Talk	Board
5.3	Electron spin resonance (ESR) and biological applications Chromatography:	3	Chalk & Talk	Black Board
5.4	Thin layer chromatography (TLC), Gas liquid chromatography (GLC)	2	Chalk & Talk	Black Board
5.5	Centrifugation: Differential centrifugation, density gradient centrifugation	1	Chalk & Talk	Black Board
5.6	Electrophoresis: Gel electrophoresis, polyacrylamide gel electrophoresis	1	Chalk & Talk	Black Board

EVALUATION PATTERN

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assess Ment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks	Assignment 5 Mks	OBT/PPT 5 Mks	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

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	Understand the structural organization and function of living cells and should able to apply the cell signaling mechanism and its electrical activities.	K2,K3	PSO1, PSO3
CO 2	Comprehension of the role of biomolecular conformation to function.	K1	PSO1, PSO3
CO 3	Conceptual understanding of the function of biological membranes and also to understand the functioning of nervous system.	K2,K5	PSO1, PSO3, PSO5
CO 4	know the effects of various radiations on living systems and how to prevent ill effects of radiations.	K1,K5	PSO1, PSO3, PSO5
CO 5	Analyze and interpret data from various techniques viz., spectroscopy, crystallography, chromatography etc.,	K4	PSO1, PSO2, PSO3, PSO5

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	**3**	**2**	**3**	**3**	**3**
CO2	**2**	**3**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4

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

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

COURSE DESIGNER:
Dr. J. SELVI

Forwarded By

Dr. A. Sheela Vimala Rani

HoD'S Signature & Name

Employability,
Skill Development
100%

SEMESTER –II

(For those who joined in 2023 onwards)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	23PG2PAE	**MODERN PHOTOGRAPHY**	**Lecture**	**4 Hrs.**	**2**

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 (12 HRS)

Introduction to photography- Personal uses- Photography Process- Writing with light-Types of Camera - Parts of a Camera: Shutter, Lens, Aperture and Films - Tools of Photography.

UNIT II: PHOTOGRAPHIC OPTICS (12 HRS)

Photographic Optics: Reflection of Light – Refraction of Light - Dispersion of

Light through Glass Prism – Lenses - Different kinds of Image Formation.

UNIT III: COMPOSITION AND TYPES OF CAMERA (12 HRS)

Composition and the Need for Composing a Picture - Elements, Rules and Conventions of Composition - Relevance in a Communication Message - Single Lens Reflex (SLR) - Pinhole – Box - Folding and DSLR - Large and Medium Format Cameras - Twin Lens Reflex (TLR)

UNIT IV: VARIOUS TYPES OF PHOTOGRAPHY AND PRACTICING INDOOR SUBJECTS (12 HRS)

Photographing People and Portrait Photography - Photographing Men, Women, Couples and Groups - Wildlife Photography - Environment Photography - Sports Photography - Usefulness of the Photographs - Landscape Photography - Practicing indoor subjects like Passport, Portrait, Article, Still life subjects and outdoor subjects like landscape and moving object photography.

UNIT V: MODERN TECHNIQUES (12 HRS)

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,* Sultan Chand & Sons.
2. Vinay Ahlawat, Gaurav Birla, Photography, Vikas Publishers.

REFERENCE BOOKS:

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

Web Sources:

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 to photography	2	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	Types of Camera	1	Lecture	Black Board & LCD
1.6	Parts of a Camera: Shutter	2	Lecture	PPT & Blackboard

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.7	Lens, Aperture and Films	2	Lecture	PPT
1.8	Tools of Photography	1	Lecture	Black Board & LCD
UNIT -2 PHOTOGRAPHIC OPTICS				
2.1	Reflection of Light	3	Lecture	LCD
2.2	Refraction of Light	3	Lecture	LCD
2.3	Dispersion of Light through Glass Prism	3	Lecture	LCD
2.4	Different kinds of Image Formation	3	Lecture	LCD
UNIT - 3 COMPOSITION AND TYPES OF CAMERA				
3.1	Composition and the Need for Composing a Picture	1	Lecture	LCD
3.2	Elements, Rules and Conventions of Composition	1	Lecture	LCD
3.3	Relevance in a Communication Message	2	Lecture	LCD
3.4	Single Lens Reflex (SLR)	2	Lecture	LCD
3.5	Pinhole - Box - Folding and DSLR	2	Lecture	LCD
3.6	Large and Medium Format Cameras	2	Lecture	LCD
3.7	Twin Lens Reflex (TLR)	2	Lecture	LCD

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT – 4 VARIOUS TYPES OF PHOTOGRAPHY AND PRACTICING INDOOR SUBJECTS				
4.1	Photographing People and Portrait Photography	2	Lecture	PPT
4.2	Photographing Men, Women, Couples and Groups	2	Lecture	PPT
4.3	Wildlife Photography - Environment Photography	2	Lecture	PPT
4.4	Sports Photography - Usefulness of the Photographs - Landscape Photography	2	Lecture	PPT
4.5	Practicing indoor subjects like Passport, Portrait, Article, Still life subjects	2		
4.6	Practicing outdoor subjects like landscape and moving object photography.	2		
UNIT-5 Modern Techniques				
5.1	Uses of “Photoshop”	2	Lecture	PPT
5.2	Practicing post production work like editing images	2	Lecture	PPT
5.3	Retouching tools and filters by Adobe Photoshop	2	Lecture	PPT
5.4	Preparation of digital ID cards	2	Lecture	PPT

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.5	Greeting cards	2	Lecture	PPT
5.6	Video making	2	Lecture	PPT

EVALUATION PATTERN

Levels	C1	C2	C3	C4	C5	Total Scholastic Marks	Non Scholastic Marks C6	CIA Total	% of Assess Ment
	T1 10 Mks.	T2 10 Mks.	Seminar 5 Mks	Assignment 5 Mks	OBT/PPT 5 Mks	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

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	Understand the basic phenomena of photography	K2	PSO1, PSO2, PSO3
CO 2	To discuss the optics behind photography	K2	PSO1, PSO2, PSO3

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 3	Comprehend the types of camera, its important control parameters and composition techniques of photography	K3	PSO1, PSO2, PSO3, PSO5
CO 4	understand the types of photography and practising indoor and outdoor objects	K2, K3	PSO1, PSO2, PSO3, PSO5
CO 5	Understand the modern technique of photoshop and develop skills to manipulate, edit and enhance the real time photographs using photoshop.	K3 & K4	PSO1, PSO2, PSO3, PSO5

Mapping of C0s with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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 C0s with POs

CO/ PSO	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:

Dr. I. Janet Sherly

Forwarded By

Dr. A. Sheela Vimala Rani

HoD'S Signature & Name

Employability,
Skill Development
100%

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 and fcc. 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 **(18 HRS)**

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 **(18 HRS)**

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: Reciprocal lattice to sc, bcc and fcc. 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

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.7	Atomic Form factor.	1	Lecture	Black 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

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

Employability,
Skill Development
100%

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

WEB REFERNCES :

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				
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

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
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 ensemble	2	Lecture	Black 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

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

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
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 5 Mks	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

S. NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 2	Acquire knowledge on Canonical 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

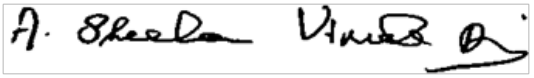
Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

COURSE DESIGNER:

1.Dr. M. V. Leena Chandra

2.Mrs. I. Jeya Sheela

Forwarded By



Dr. A. Sheela Vimala Rani

HoD's Signature & Name

Employability, Skill Development 100%

II M.Sc. PHYSICS

SEMESTER –III

For those who joined 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 "Nuclear Physics" Umesh Prakashan- 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
    a. Publishing Company.

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
1.5	Gamow's Theory of alpha decay, (decay probability, hindrance factors, spontaneous nuclear disintegration)	2	Lecture	Black Board

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

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.7	The Semi- empirical mass formula	2	Chalk & Talk	Black Board
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

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.3	Particle Interactions (Gravitational, Electromagnetic, Strong, Weak)	2	Discussion	Google class room
5.4	Conservation laws-	2	Chalk & Talk	Black 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 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 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

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

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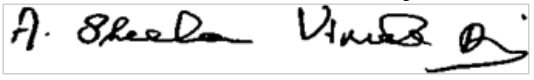

Dr. A. Sheela Vimala Rani
HoD's Signature & Name

Employability,
Skill Development
100%

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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Employability,
Skill Development
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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	19PG3P17	Practicals VI Advanced Electronics Lab	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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Employability, Skill Development 100%

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 **(18 HRS)**

Point defects - Lattice vacancies: Schottky defect, Frenkel defect- Diffusion: Metals- Color centers: 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 **(18 HRS)**

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 **(18 HRS)**

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 **(18 HRS)**

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. Ferromagnetic domains**:** 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.- Elementary Solid 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	Electrostatic screening**:** 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
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	Color centers: 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 –	4	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	Microwave and infrared properties – Isotope effect.			
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
UNIT -4 DIELECTRICS 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	5	Lecture	OHP

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	transitions**:** Soft Optical Phonons – Landau theory of the phase transition – second order transition – first transition –			
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 color centers in crystals Compare the behaviour of normal conductor and superconductor Explain superconductivity based on various models and theories	K1, K2, K3	PSO3, PSO4
CO 3	Identify dielectric medium and analyze their polarization properties	K1, K2, K3	PSO1,PSO3
CO 4	Identify magnetic solids and their properties	K1 , K2	PSO2,PSO5

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
	Apply quantum theory and analyze the magnetisation and susceptibility properties		
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

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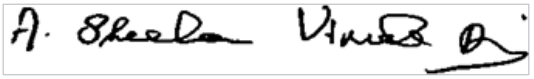

Dr. A. Sheela Vimala Rani
HoD's Signature & Name

Employability,
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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
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 & Chemical analysis by Microwave spectroscopy	1	Lecture	Black Board
1.11	Problem solving & Test	4	Lecture	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
				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
3.4	Symmetric Top Molecules	1	Lecture	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
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
4.6	The Fortrat Diagram	2	Lecture	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
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 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. **Dr.Sr.G.Jenita Rani**
2. **Dr. R. Jothi Mani**

Forwarded By

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

Employability,
Skill Development
100%

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)

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
	The hydrogen molecules.	2	Chalk & Talk	Black Board
2.3	**The WKB Approximation**- The one dimensional Schrödinger equation: a) the asymptotic solution	4	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	solution near a turning point c) matching at a linear turning point d) Asymptotic connection formula	3	Chalk & Talk	Black Board
2.4	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:	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	Perturbative solution for transition amplitude			
	Selection rules – First order transitions	1	Chalk & Talk	Black Board
	Constant perturbation a) Transition probability	2	Chalk & Talk	Black Board
	b)closed spaced levels:constant transition rate-	2	Discussion	Google classroom
4.2	Harmonic perturbations a) amplitude for transition with change of energy	2	Chalk & Talk	Black Board
	b) Transitions induced by incoherent spectrum of perturbing frequencies	2	Lecture	PPT
4.3	Interaction of an atom with electromagnetic radiation	2	Chalk & Talk	Black Board
4.4	The dipole approximation: selection rules	3	Discussion	Google classroom
4.5	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

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.3	The Dirac Equation: Dirac's relativistic Hamiltonian	1	Chalk & Talk	Black Board
5.4	Position probability density: expectation values	1	Lecture	PPT
5.5	Dirac matrices- Plane wave solutions of the Dirac equation	3	Lecture	PPT
5.6	energy spectrum- The spin of the Dirac particle – Significance of negative energy states;	2	Discussion	Google classroom
5.7	Dirac particle in Electro magnetic fields	2	Chalk & Talk	Black Board
5.8	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	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**	**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 C0s 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/ PSO	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:

Staff Name : Dr.A.Sheela Vimala Rani

Dr. Ancemma Joseph

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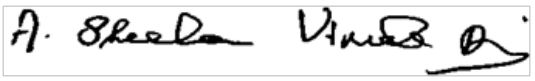

Dr. A. Sheela Vimala Rani
HoD's Signature & Name

SEMESTER –IV

For those who joined in 2019 onwards

Employability,
Skill Development
100%

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	19PG4P21	Practicals VII Advanced General Physics Experiments	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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Employability,
Skill Development
100%

II M.Sc.PHYSICS

SEMESTER –IV

For those who joined in 2019 onwards

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 with Computational Programming skills.

COURSE OBJECTIVES

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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Employability,
Skill Development
100%

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 (12 HRS)

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. (Self study) FIBER OPTIC COMMUNICATIONS:** Introduction-Light sources for fiber optics- Photodetectors- Connectors and Splices- Fiber optic communication link.

UNIT V: ANTENNAS AND MICROWAVE TUBES (12 HRS)

Basic considerations – Wire radiators in space- Terms and definitions- **Effects of ground on antennas- antenna coupling at medium frequencies (Self study)**- 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 (III Edition)

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 and current for sinusoidal AM	1	Chalk & Talk	Black Board
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

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
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	K1/K2/K3	PSO4

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
	the principle of optical fiber communication		
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**

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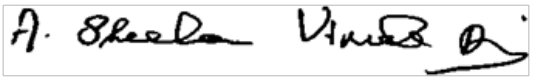


Dr. A. Sheela Vimala Rani
HoD's Signature & Name

Employability, Skill Development 100%

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. Kanetkar Yashavant, 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 forward interpolation formula for Equal Intervals	2	Chalk & Talk	Black 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

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.7	Lagrange's Interpolation Formula for unequal Intervals	2	Lecture	Black Board
UNIT -2 NUMERICAL DIFFERENTIATION AND INTEGRATION				
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		
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

Employability, Skill Development 100%

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 of nanotubes (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.Richard Brundle, 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

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.8	elastomers	1	Discussion	Black 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

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.2	chemical vapour deposition -	1	Chalk & Talk	LCD
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

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.5	Differential thermal analysis-differential scanning calorimetry	1	Lecture	Black Board
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

Employability,
Skill Development
100%

II M.Sc.PHYSICS

SEMESTER –IV

(*For those who joined in 2019 onwards*)

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).(self study)**

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 Baidhyanath Basu
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

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

EMPLOYABILITY,
SKILL DEVELOPEMENT:100%

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

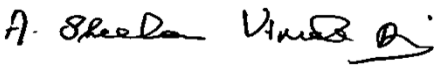
2. The Latex Companion, 2nd edition, Frank Mittelbach, Michel Goossens, Johannes Braams, David Carlisle, Chris Rowley, 2004, Addison Wesley Professional

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

EMPLOYABILITY, SKILL DEVELOPEMENT:100%

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 desigh in Physics and
   EngineeringMichael Sayer and Abhai Mansingh, 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. 1997
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

EMPLOYABILITY, SKILL DEVELOPEMENT:100%

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 the Essence of Nanotechnology – Finding out what it is- Thedefinition - Size comparisons Theapplications -two approaches to fabricating at the nano scale- evolving into Nanotech -Why nanotechnology - Security– Healthcare - Resources - What we have and What will be improved – What will be new.

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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EMPLOYABILITY,
SKILL DEVELOPEMENT:100%

II M.Sc.

SEMESTER –III & IV

For those who joined in 2022 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	22PGSLP1	Digital Signal Processing	Self Learning Course for Advanced Learners	-	3

COURSE DESCRIPTION

This course is an informative and comprehensive course which covers the concepts and techniques of modern digital signal processing which are fundamental to all the signal/speech/image processing, applications

COURSE OBJECTIVES

The objective of this course is to provide background and fundamental material for the analysis and processing of digital signals and to familiarize the relationships between continuous-time and discrete-time signals and systems. This course also gives the fundamentals of time, frequency and z-plane analysis and introduces real world signal processing applications.

UNITS

UNIT –I SIGNALS, SYSTEMS AND SIGNAL PROCESSING (15 HRS.)

Signals, Systems and Signal Processing - Basic elements of Digital Signal Processing System – Advantages of Digital over Analog Signal processing – Classification of signals – Concept of Frequency in continuous -time and discrete time signals.

UNIT –II Analog to Digital and Digital to Analog Conversion (15HRS.)

Analog to Digital and Digital to Analog conversion – Sampling – Sampling theorem – Quantization and coding – Digital to Analog Conversion – Analysis of Digital Signals and Systems versus Discrete Time signals and systems

UNIT –III Discrete Time signals and systems (15 HRS.)

Discrete Time Signals – some Elementary Discrete – Time Signals – classification of Discrete Time signals – Block Diagram Representation of Discrete Time Systems – Classification of Discrete time systems

UNIT –IV Z Transform and its application (15 HRS.)

Z Trasform, Rational Z Transforms, Inversion of Z- transforms, stability and causality.

UNIT –V Discrete Fourier transform (15HRS.)

Interpretations of DFT –- Relationship of DFT to z transform – Properties of DFT – FFT Algorithms

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only) (HRS.)

Real world signal processing applications

Text Book:

John G. Proakis, Dimitris G. Manolakis (2007), Digital Signal Processing, Principles, Algorithms, and Applications,Pearson Education / PHI, India..

REFERENCES:

1. A.V. Oppenheim, R. W. Schaffer (2009), Discrete Time Signal Processing, Prentice Hall of India, New Delhi.
2. Andreas Antoniou (2006), Digital Signal Processing, Tata McGraw Hill, NewDelhi

COURSE DESIGNER:

Dr.Ancemma Joseph

Forwarded By

HOD'S Signature & Name

II M.Sc.

SEMESTER–III & IV

Employability,

Skill developement:100%

For those who joined in 2022 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PAPH	22PG4SLCP	Batteries and its applications	Self Learning	-	2

Course Objective:

This course gives a detailed studyof electrochemistry and Batteries.

Units

Unit-I

Galvanic cells and EMF–electrode reactions–electrode potentials and cell reactions–representations of electrodes– sign conventions.

Unit-II

Electrochemical series– measurements of EMF- Construction of electrochemical cells–Applications.

Unit-III

Types of Batteries (Primary and secondary Batteries)

Unit-IV

Lithium Ion Batteries, Advantages and disadvantages-Working of Li-Ion Battery.

Unit-V

Clean Energy Institute-Supercapacitor battery,Charging and Working.

TextBook:

1.The principles o fPhysical chemistry by Puri, Sharma and Pathania.

Reference Book:

1.Introduction to Electrochemistry By Samuel Glasstone

COURSE DESIGNER:

Dr.JeyaSheela

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HOD'S Signature & Name