SRI MEENAKSHI GOVT.ARTS COLLEGE FOR WOMEN (A),

MADURAI - 625 002

Reaccredited with “A” by NAAC

M.Sc., PHYSICS SYLLABUS FOR THE ACADEMIC YEAR 2022 - 2023

DEAPRTMENT OF PHYSICS

CHOICE BASED CREDIT SYSTEM SYLLABUS

FOR STUDENTS ADMITTED FROM JUNE 2022

SRI MEENAKSHI GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS)

MADURAI – 625 002

Programme : M.Sc Physics

SEMESTER –I

Course Type	Code	Title of the Course	Hrs/ Week	Credit	Exam Hrs	Marks		
						Int	Ext	Total
CCI	P22CP1	Mathematical Physics-I	6	5	3	25	75	100
CC II	P22CP2	Classical Mechanics	5	4	3	25	75	100
CC III	P22CP3	Advanced Electronics	6	5	3	25	75	100
CCIV	P22CP4P	Physics Practical – I	6	3	5	40	60	100
DSEC- I	P22DSP1A	Microprocessor and Micro controller	5	4	3	25	75	100
	P22DSP1B	Microprocessor and Embedded microcontroller						
SEC –I	P22SEP1	Solar Energy and its Applications	2	2	3	25	75	100
		Total	**30**	**23**				**600**
SEMESTER –II								
CCV	P22CP5	Mathematical Physics-II	6	4	3	25	75	100
CCVI	P22CP6	Quantum Mechanics-I	6	5	3	25	75	100
CCVII	P22CP7	Electromagnetic Theory	5	4	3	25	75	100
CCVIII	P22CP8P	Physics Practical–II	6	3	5	40	60	100
DSEC-II	P22DSP2A	Programming in C++	5	4	3	25	75	100
	P22DSP2B	Computational Physics						
SEC- II	P22SEP2	**Nanoscience and Nano technology**	2	2	3	25	75	100
		Total	**30**	**22**				**600**

SEMESTER – III								
Course Type	**Code**	**Title of the Course**	**Hrs/ Week**	**Credit**	**Exam Hrs**	**Marks**		
						Int	**Ext**	**Total**
CC– IX	P22CP9	Condensed Matter Physics –I	6	5	3	25	75	100
CC– X	P22CP10	Quantum Mechanics-II	6	5	3	25	75	100
CC – XI	P22CP11	Molecular Spectroscopy	5	5	3	25	75	100
CC–XII	P22CP12P	Physics Practical – III	6	3	5	40	60	100
DSEC–III	P22DSP3A/ P22DSP3B	Crystal Growth and Thin Films / Plasma Physics	5	4	3	25	75	100
NMEC –I	P22NMP1	Batteries and their Applications	2	2	3	25	75	100
		Total	**30**	**24**				**600**
SEMESTER –IV								
CC–XIII	P22CP13	Condensed Matter Physics –II	6	4	3	25	75	100
CC–XIV	P22CP14	Nuclear and Particle Physics	6	4	3	25	75	100
CC-XV	P22CP15P	Physics Practical – IV	5	4	5	25	75	100
CC– XVI	P22CPPW	Project	8	5	-	40	60	100
DSEC – IV	P22DSP4A / P22DSP4B	Laser and non linear optics / Introduction to Bose – Einstein Condensation (BEC), Superfluidity and Superconductivity	5	4	3	25	75	100
		Total	**30**	**21**				**500**

COURSE STRUCTURE ABSTRACT FOR M.Sc., PHYSICS

PART	COURSES	TOTAL NO OF COURSES	HOURS	CREDIT	MARK
III	Core Course	15	86	63	1500
III	Core Project	1	8	5	100
III	Discipline Specific Elective Course	4	20	16	400
III	Non-Major Elective Course	1	2	2	100
III	Skill Enhancement Course	2	4	4	200
Total		**23**	**120**	**90**	**2300**

PART	SEMESTER	COURSE TYPE	TITLE OF THE COURSE	HRS/ WEEK	CREDITS
III	I	DSEC-I	ELECTIVE - 1 - MICROPROCESSOR AND MICRO CONTROLLER ELECTIVE – 1 - MICROPROCESSOR AND EMBEDDED MICRO CONTROLLER	5	4
III	II	DSEC-II	ELECTIVE - 2 - PROGRAMMING IN C++ ELECTIVE - 2 - COMPUTATIONAL PHYSICS	5	4
III	III	DSEC-III	ELECTIVE- 3 -CRYSTAL GROWTH AND THIN FILMS ELECTIVE - 3 - PLASMA PHYSICS	5	4
IV	IV	DSEC-IV	ELECTIVE - 4 - LASER AND NON LINEAR OPTICS ELECTIVE - 4 - INTRODUCTION TO BOSE – EINSTEIN CONDENSATION (BEC) , SUPERFLUIDITY AND SUPERCONDUCTIVITY	5	4

SKILL ENHANCEMENT COURSE (SEC)

PART	SEMESTER	COURSE TYPE	TITLE OF THE COURSE	HRS/ WEEK	CREDITS
III	I	SEC-I	SOLAR ENERGY AND ITS APPLICATIONS	2	2
III	II	SEC-II	NANOSCIENCE AND NANO TECHNOLOGY	2	2

NON-MAJOR ELECTIVE COURSES

OFFERED BY DEPARTMENT OF PHYSICS

PART	SEMESTER	COURSE TYPE	TITLE OF THE COURSE	HRS/ WEEK	CREDITS
IV	III	NMEC-1	BATTERIES AND THEIR APPLICATIONS	2	2

QUESTION PAPER PATTERN

I YEAR PG

Section – A	Section-B
Internal choice questions (5 * 5 = 25)	Internal choice questions (5 * 10 = 50)
I to V units equal distribution	

Programme : M.Sc. **Core - I**
Semester : I **Hours : 6 Hrs P/W 90 Hrs P/S**
Sub. Code : P22CP1 **Credits : 5**

TITLE OF THE PAPER : Mathematical Physics I

Pedagogy	Hours	Lecture	Peer Teaching	GD/Videos/Tutorial	ICT
	6	3	1	2	-

PREAMBLE: The purpose of the course is to introduce students to methods of mathematical physics and to develop required mathematical skills to solve problems in quantum mechanics, electrodynamics and other fields of theoretical physics.

Course Outcome At the end of the semester, the students will be able to	Unit	Hrs P/S
CO1: describe the vector analysis and vector spaces	I	18
CO2: solve the problems using Matrices	II	18
CO3: apply the Special functions – I	III	18
CO4: interpret the Special functions – I	IV	18
CO5: solve the problems using Group theory	V	18

SYLLABUS

UNIT I: VECTOR ANALYSIS AND VECTOR SPACES

Concept of gradient, divergence and curl - Gauss's divergence theorem, Green's theorem and Stoke's theorem (statement and proof) - orthogonal curvilinear coordinates - expression for gradient, divergence, curl and laplacian in cylindrical and spherical co-ordinates (theory) - linearly dependent and independent sets of vectors.

UNIT II: MATRICES

Types of matrices and their properties - rank of a matrix - eigenvalue equations and their solutions - theorems on matrices - diagonalisation - diagonalisation of different matrices - cayley-hamilton's theorem - problems.

UNIT-III: SPECIAL FUNCTIONS – I

Gamma and beta function- legendre's diffferential equation: legendre polynomials - generating functions - recurrence relation - rodrigue's formula - orthogonality; bessel's differential equation: bessel polynomials - generating functions - recurrence relation -rodrigue's formula – orthogonality.

UNIT-IV: SPECIAL FUNCTIONS – II

Hermite differential equation – generating functions – hermite polynomials - recurrence relations – rodrigue's formula - orthogonality: laguerre differential equations – generating functions - laguerre polynomials - recurrence relation - rodrigue's formula – orthogonality.

UNIT-V: GROUP THEORY

Definition - subgroups - cyclic groups and abelian groups - homomorphism and isomorphism of groups - classes - symmetry operations and symmetry elements - representations of groups - reducible and irreducible representations - character tables for simple molecular types (c2v and c3v point group molecules)

TEXT BOOKS:

1.Mathematical Physics - S.L. Kakani, C. Hemrajani 2nd Edition CBS Publishers &Distributors Pvt. LTD., 2010.

UNIT - I Ch.1 (sec. 1.1 - 1.6, 1.8 - 1.16)
Unit - II Ch.2 (sec. 2.1 - 2.4, 2.8 - 2.12)
Unit – III Ch.4 & 7 (sec. 4.3,4.5,7.5,7.7)
Unit - IV Ch.7 (sec. 7.10,7.11)

2. Mathematical Physics with classical mechanics - Satyaprakash, 6th edition Sultan Chand &Sons, 2013

Unit - V Ch. 13 (sec. 13.1, 13.4, 13.5, 13.7, 13.12, 13.13, 13.18, 13.19, 13.21, 13.22, 13.25, 13.26)

BOOKS FOR REFERENCE:

1. B. D. Gupta, Mathematical Physics 4th edition Vikas Publishing House Pvt. Ltd. 2013
2. E. Balagurusamy, Numerical methods Tata McGraw – Hill Publishing company Ltd., 1999
3.Arkfen&Weber, Essential Mathematical Methods for Physicists, Academic Press, 2005.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I	Concept of gradient, divergence and curl - gauss's divergence theorem, green's theorem and stoke's theorem (statement and proof)	6	Lecture, Peer Teaching & Tutorial
	orthogonal curvilinear coordinates - expression for gradient, divergence, curl and laplacian in cylindrical and spherical co-ordinates	6	Lecture, Peer Teaching & Tutorial
	linearly dependent and independent sets of vectors	6	Discussion and by lecturing through ICT (power point presentation
UNIT II	Types of matrices and their properties, rank of a matrix, eigenvalue equations and their solutions, t	6	Lecture , Peer Teaching & Tutorial
	theorems on matrices; diagonalisation and diagonalisation of different matrices;	6	Lecture & Tutorial
	Cayley-hamilton's theorem; problems.	6	Lecture & Tutorial
UNIT III	Gamma and beta function- legendre's diffferential equation: legendre polynomials - generating functions -	6	Lecture, Group discussion and Seminar
	rodrigue's formula - orthogonality; bessel's differential equation: bessel polynomials	6	Lecture & Tutorial
	generating functions - recurrence		

	relation -rodrigue's formula – orthogonality.	6	Lecture, Group discussion and Seminar
UNIT IV	Hermite differential equation – generating functions – hermite polynomials - recurrence relations –	6	Lecture & Tutorial
	rodrigue's formula - orthogonality: laguerre differential equations – generating functions - laguerre polynomials	6	Lecture & Tutorial
	- recurrence relation - rodrigue's formula – orthogonality.	6	Lecture & Tutorial
UNIT V	Definition - subgroups - cyclic groups and abelian groups - homomorphism and isomorphism of groups - classes - symmetry operations and symmetry elements	6	Lecture, Group discussion and Seminar
	representations of groups - reducible and irreducible representations	6	Lecture & Tutorial
	character tables for simple molecular types (c2v and c3v point group molecules)	6	Lecture & Tutorial

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	5	3	4	4	3	3	3	4	5	3.8
CO2	4	4	3	3	3	4	5	4	3	4	3.7
CO3	3	3	4	5	4	5	4	5	5	3	4.1
CO4	4	3	3	4	3	5	3	4	4	3	3.6
CO5	3	4	3	3	4	3	3	3	4	3	3.3
Mean Overall score											3.7

Result: The Score for this Course is **3.7** (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = Total of Value / Total No. of POs& PSOs	Mean Overall Score of COs = Total of Mean Score / Total No. of COs

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1: Remembering/ recalling.	30%	30%
K2: Understanding/ comprehension.	30%	30%
K3: Application and analysis.	40%	40%

Course Designer : **Dr. Mrs. G. SAROJA** Department of physics

Programme : M.Sc., PHYSICS **Part III: MAJOR Core**
Semester : I **Hours : 5 P/W , 75 Hrs P/S**
Sub. Code : P22CP2 **Credits : 4**

TITLE OF THE PAPER: CLASSICAL MECHANICS

Pedagogy	Hours	Lecture	Peer Discussion/Teaching	GD/VIDOES/TUTORIAL	ICT
	5	2	1	1	1

PREAMBLE: Understanding and acquire the prerequisite concepts to the inadequacy in classical mechanics so that we can transit from classical to quantum mechanics which gives an insight into the interesting correlation.
Understanding and applying the connection between the theory and experiment.

COURSE OUTCOME At the end of the Semester, the Students will be able to	**Unit**	**Hrs P/S**
CO1: Describe prerequisite concepts to the inadequacy in classical mechanics so that we can transit from classical to quantum mechanics this gives an insight into the interesting correlation and Lagrangian Formulation.	**I**	**15 hrs**
CO2: Study Hamilton's Principle and Lagrange's equation and the kinematics of the rigid body through Euler equation.	**II**	**15 hrs**
CO3: Explain The Hamilton-Jacobi equations and normal coordinates.	**III**	**15 hrs**
CO4: Obtain the Orthogonal transformation and Angular Momentum and Kinetic Energy of Motion about a Point.	**IV**	**15 hrs**
CO5: Get knowledge in central force field and relativity.	**V**	**15 hrs**

SYLLABUS

UNIT- I: LAGRANGIAN FORMULATION :

Introduction – Basic Concepts - System of particles- Degrees of freedom - Constraints (only Types with Examples) - Generalized Coordinates - Principle of Virtual Work- D'Alembert's Principle (only Derivation) - Procedure for Formation of Lagrange's Equations - Applications of Lagrange Equations of Motion – Simple Pendulum - Generalized Momentum and Cyclic Co-ordinates - Conservation Theorems.

UNIT –II: HAMILTON'S EQUATION AND CANONICAL TRANSFORMATION:

Introduction - Hamilton's Principle and Lagrange's equations - Hamilton`s function H and Conservation of Energy : Jacobi's Integral - The Calculus of variation and Euler- Lagrange's Equation – Deduction of Lagrange's equation from Variational Principle - Principle of least action- Canonical Transformation -Legendre transformation - Poisson brackets and its Properties – Lagrange Brackets.

UNIT-III: HAMILTON-JACOBI THEORY AND SMALL OSCILLATIONS:

Introduction – The Hamilton-Jacobi equations –Solution of Harmonic oscillator problem by Hamilton – Jacobi Method - Kepler problem by Hamilton – Jacobi Method - Normal Coordinates-Normal Modes - Eigen Value Equation -Vibrations of Linear Tri atomic Molecule.

UNIT-IV: THE KINEMATICS OF RIGID BODY MOTION :

Introduction - Independent coordinates of rigid body-orthogonal transformation- The Euler angles – Euler's Theorem on the Motion Of a Rigid Body - Angular Momentum and Kinetic Energy of Motion about a Point – Torque - Free Motion of a Rigid Body.

UNIT-V: CENTRAL FORCE PROBLEM AND THEORY OF RELATIVITY:

Introduction - Centre of mass - Reduction to the equivalent one body problem- Equation of Motion under Central Force and First integrals – Inverse-Square law of Force - Scattering in a Central force field – Scattering Cross- Section – Scattering Angle, Impact Parameter –Examples of Mass-Energy Conversion - Lorentz transformation for Force - Relativistic Lagrangian and Hamiltonian of a Charged Particle in an Electro Magnetic Field – Velocity Dependent Potentials.

BOOKS FOR STUDY:

1. **Classical Mechanics** - J.C. Upadhyaya -Himalaya Publishing House Pvt.Ltd, Bangalore, Second edition,**2017.**

   UNIT-I: Chapter : 2 & 3 - (**Sec**: 2.1 – 2.3.3, 2.4- 2.6, 2.8 & 3.2, 3.3).

   UNIT –II: Chapter 2, 3, 5, 6 & 7 – (**Sec:** 2.11, 3.4, 5.2, 5.6, 5.11, 6.1, 6.2 & 7.2, 7.3).

   UNIT-III: Chapter 8 & 9 – (**Sec:**8.1 – 8.3, 8.5, 9.3.2, 9.4.2 & 9.6)

   UNIT-V: Chapter 1, 4 and 13 – (**Sec:**1.7.2, 4.1, 4.3, 4.5, 4.10, 13.4, 13.9 & 13.12).

2. **Classical Mechanic**s - H. Goldstein, C. Poole and J. Safko,Pearson Education Asia, New Delhi, Third Edition,**2002.**

   UNIT-IV: Chapter 4 and 5 - (**Sec:**4.1, 4.2, 4.4, 4.6 and 5.1 & 5.6)

REFERENCE BOOKS:

1. **Classical Mechanics** - G. Aruldhas, PHI Learning Private Limited, New Delhi,**2015.**
2. **Classical Mechanics** -S. L. Gutpa, V. Kumar and H.V. Sharma, Pragati Prakashan, Meerut ,**2016.**
3. **ClassicalMechanics of Particles and Rigid Bodies** -K.C. Gupta, New Age International Publishers, New Delhi, Third edition,**2018.**
4. **Classical Mechanics** -N.C. Rana and P.J. Joag, Tata McGraw Hill, New Delhi, **2015.**
5. **Classical Mechanics-** B.D.Gupta and Satya Prakash, Keder Nath Publishers,Meerut, Revised Edition,**2015.**
6. **Introduction to Classical Mechanics -** R.G.Takwale and P.S.Puranik, Tata Mc Graw Hill, New Delhi,**1989**.

Web REFERENCE:

1. https://www.britannica.com/science/classical-mechanics

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I	**Introduction** – Basic Concepts - System of particles- Degrees of freedom - Constraints (only Types with Examples)	**4 hrs**	Motivation by asking questions – peer group discussion and by lecturing through ICT (power point presentation)
UNIT I	Generalized Coordinates - Principle of Virtual Work- D' Alembert's (only Derivation)	**3 hrs**	Lecturing – deriving the expression by group discussion
	Procedure for	**4 hrs**	Peer group teaching and

	Formation of Lagrange's Equations - Applications of Lagrange Equations of Motion		lecturing
	Simple Pendulum - Generalized Momentum and Cyclic Co-ordinates - Conservation Theorems.	**4 hrs**	Lecturing with discussion and deriving the expression along with example problems
UNIT II	**Introduction -** Hamilton's Principle and Lagrange's equations - Hamilton`s function H and Conservation of Energy	**4 hrs**	Lecturing – deriving the expression by group discussion.
	Jacobi's Integral - The Calculus of variation and Euler- Lagrange's Equation	**4 hrs**	Lecturing – deriving the expression by group discussion.
	Deduction of Lagrange's equation from Variational Principle - Principle of least action- Canonical Transformation	**3 hrs**	Lecturing – deriving the expression by group discussion.
	Legendre transformation - Poisson brackets and its Properties – Lagrange Brackets.	**4 hrs**	Lecturing – deriving the expression by group discussion.
UNIT III	**Introduction** – The Hamilton-Jacobi equations	**4 hrs**	Motivation by asking questions – peer group discussion and by lecturing through ICT (power point presentation)
	Solution of Harmonic oscillator problem by Hamilton	**4 hrs**	Lecturing – deriving the expression by group discussion and emphasizing the importance of H
	Jacobi Method - Kepler problem by Hamilton – Jacobi Method	**3 hrs**	Peer group teaching and discussion.
	Normal Coordinates-		Lecturing with discussion

	Normal Modes	**2 hrs**	and deriving the expression along with example problems.
	Eigen Value Equation - Vibrations of Linear TriatomicMolecule.	**2hrs**	Lecturing – deriving the expression by group discussion.
UNIT IV	**Introduction** - Independent coordinates of rigid body-orthogonal transformation	**5hrs**	Motivation by asking questions – peer group discussion and by lecturing through ICT (power point presentation)
	The Euler angles – Euler's Theorem on the Motion Of a Rigid Body	**5 hrs**	Lecturing – deriving the expression by group discussion and emphasizing the Motion Of a Rigid Body by Euler's Theorem
	Angular Momentum and Kinetic Energy of Motion about a Point – Torque - Free Motion of a Rigid Body.	**5 hrs**	Peer group discussion and lecturing
UNIT V	**Introduction** - Centre of mass - Reduction to the equivalent one body problem	**3 hrs**	Motivation by asking questions – peer group discussion and by lecturing through ICT (power point presentation)
	Equation of Motion under Central Force and First integrals	**3hrs**	Lecturing – deriving the expression by group discussion
	Inverse-Square law of Force - Scattering in a Central force Field	**2 hrs**	Peer group discussion and deriving the expression
	Scattering Cross-Section – Scattering Angle, Impact Parameter	**2 hrs**	Lecturing with discussion and deriving the expression along with example problems
	Examples of Mass-Energy Conversion - Lorentz transformation for Force	**3 hrs**	Lecturing – deriving the expression by peer teaching.

	Relativistic Lagrangian and Hamiltonian of a Charged Particle in an ElectroMagnetic Field – Velocity Dependent Potentials.	**2 hrs**	Lecturing – deriving the expression by group discussion

Course Outcomes (COs)	**Programme Outcomes (POS)**					**Programme Specific Outcomes (PSOs)**					**Mean scores of Cos**
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	3	3	3	3	4	4	3	3	3.3
CO2	3	3	4	4	3	3	3	3	3	4	3.3
CO3	3	4	3	3	3	4	3	4	3	3	3.3
CO4	3	3	3	4	3	4	3	4	3	3	3.3
CO5	4	3	4	4	4	3	4	4	4	3	3.7
Mean Overall Score											3.38

Result: The Score for this Course is **3.38** (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value / Total No. of POS& PSOs			Mean Overall Score of COs = Total of Mean Score / Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1:REMEMBERING/RECALLING.	20%	20%
K2: UNDERSTANDING / COMPREHENSION.	20%	20%
K3: APPLICATION AND ANALYSIS.	30%	30%
K4: SYNTHESIS AND EVALUATION.	30%	30%

Course Designer : **Dr. Mrs. SANTHI.** Department of PHYSICS

Programme : M.Sc **Part III: Core - III**
Semester : I **Hours : 6 P/W 90Hrs P/S**
Sub. Code : P22CP3 **Credits: 5**

TITLE OF THE PAPER: ADVANCED ELECTRONICS

Pedagogy	Hours	Lecture	Peer Teaching	GD/ Videos/Tutorial	ICT
	6	3	2	1	1

PREAMBLE: To impart knowledge about various semiconductor diodes,Transistors,registers , counters, and Operational Amplifiers and their applications and analog to digital conversion techniques.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO 1: Differentiate various semiconducting diodes by comparing their principles and working and its applications.	I	18
CO 2:understand thecharacteristics and applications of operational amplifier	II	18
CO 3: describe the design concepts of counters and shift registers	III	18
CO 4: explain the various techniques to develop A/D and D/A converters	IV	18
CO 5:understand and explain the function of data processing circuits and their applications	V	18

SYLLABUS
ADVANCED ELECTRONICS

UNIT I : SEMICONDUCTOR DEVICES

Zener diode- Gunn diode- Tunnel diode-Varactor diode-schottky diode- Characteristics and Applications. Transistor Characteristics in CE configuration –Transistor biasing and stabilization- The D.C. Operating Point and Load line-SimplerwayofdrawingaD.C.Loadline–Q-PointandMaximumundistortedoutput–FactorsaffectingstabilityofQ-point–Stability factor- Stability factor of common base and common emitter circuits.

UNIT-II : OPERATIONAL AMPLIFIER APPLICATIONS

Operational Amplifier - Op- Amp Parameters - Ideal Operational Amplifiers - Virtual Ground and Summing Point - Inverting Amplifier - Non - Inverting Amplifier - The Integrator - The Differentiator – Log amplifier- Antilog amplifier -Voltage to Current Converter with Floating Load - Current to Voltage Converter - Op-Amp Based Oscillator Circuits - Op-Amp Based - A Square - wave Relaxation Oscillator - A Triangular - wave Relaxation Oscillator - Active Filters(First order only) - Low – Pass Filter - High – Pass Filter - Band Pass Filter

UNIT III : REGISTERS AND COUNTERS

Types of registers-Serial in-Serial Out-Serial in –Parallel Out-Parallel in-Serial Out- Parallel in-Parallel Out - Asynchronous Counters- Decoding Gates-Synchronous Counter(using 3 bit only)-Changing the Counter Modulus (using Mod 3 only) -Decade counter (using Mod 5 only).

UNIT IV : D/A CONVERSION AND A/D CONVERSION

Variable resistor networks-Binary Ladder– D/A converters-D/Accuracy and resolution.- A/D converter- simultaneous conversion –counter method–continuous A/D conversion-A/D Techniques Dual slope A/D conversion-A/D accuracy and resolution.

UNIT V : DATA PROCESSING CIRCUITS

Multiplexers- Demultiplexers- 1-of -16 Decoder- BCD to Decimal Decoder- Seven segment Decoders- Encoders - Exclusive OR Gates- Parity Generators and Checkers- Magnitude comparator.

TEXT BOOKS:

1.Applied Electronics by R,SEDHA, S.Chand Publications Reprint 2015

UNIT I- Ch. 13,15 & 22 (sec-13.1 - 13.3,13.6- 13.9,13.11,13.12.13.14- 13.16,15.6-15.8,22.2-22.8)

UNITII-Ch.35&36

(Sec35.1,35.6,35.9,35.10,35.12,35.13,,36.1136.15,36.17,36.18,36.24,34.26,36.28,36.29,36.32,36.34, 36.36-36.39)

2. Donald P Leach, Albert Paul Malvino Goutam Saha, Digital Principles and Applications, Seventh edition , Mc Graw Hill companies, 2011

UNIT III- Ch. 9 (sec-9.1-9.5)

Ch.10 (sec-10.1-10.5)

UNIT IV- Ch. 12(sec.12.1-12.10)

UNIT V- Ch- 4(Sec 4.1 - 4.9)

REFERENCES BOOKS:

1. Jacob Millman,ChristosC.Halkias, Satayabrata Jit, **Electronic devices and circuits** Third Edition,Tata Mc. Graw Hill Education, 2010.
2. Herbert Taub Donald Schilling,**Digital Integrated electronics**, Mc Graw Hill International editions, 1987.
3. William Stanley, **Operational Amplifier with linear integrated circuits**, CBS Publishers,1988.
4. Robert L.Boylestad Louis Nashelsky, **Electronic devices and circuit Theory**,Tenth Edition, Pearson education ,2009.
5. R.P.Jain, **Modern Digital Electronics**-Tata Mc Graw Hill,2010.
6. A.P.Godse. D.A. Godse, **Digital Electronics**, Third revised edition,Technical Publications, 2008.
7. S.Salivanan, N.SureshKumar,A.Vallavaraj, **Electronic devices and circuits,** Second Edition, Tata Mc Graw Hill companies, 2008.

Web Resources

1. https://www.elprocus.com/types-of-diodes-and-applications/
2. https://www.monolithicpower.com/en/operational-amplifiers
3. https://www.electronics-notes.com/articles/analogue_circuits/operational-amplifier-op amp/circuits.php
4. https://www.geeksforgeeks.org/shift-registers-in-digital-logic/
5. https://www.geeksforgeeks.org/counters-in-digital-logic/
6. https://www.utmel.com/blog/categories/integrated%20circuit/a-d-converter-basic-principle-and-types
7. https://www.elprocus.com/what-is-multiplexer-and-demultiplexer-types-and-differences/

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I	Zener diode- Gunn diode- Tunnel diode-Varactor diode-schottky diode- Characteristics andApplications.	6	Lecture , , ICT ,Group discussion
	Transistor Characteristics in CE configuration -Transistorbiasing and stabilization- The D.C. Operating Point and Load line-Simpler way of drawing a D.C.Loadline–	6	Lecture,ICTand seminar
	Q-PointandMaximumundistortedoutput–FactorsaffectingstabilityofQ-point–Stability factor- Stability factor of commom base and common emitter circuits.	6	Lecture , , ICT and Assignment
UNIT II	Operational Amplifier - Op- Amp Parameters - Ideal Operational Amplifiers - Virtual Ground and Summing Point - Inverting Amplifier - Non - Inverting Amplifier	6	Lecture , , ICT, Group discussion and Seminar
	Summing Amplifier – Subtractor - The Integrator - The Differentiator - Voltage to Current Converter with Floating Load - Current to Voltage Converter	6	Lecture , , ICT and Group discussion
	Op-Amp Based Oscillator Circuits - Op-Amp Based - A Square - wave Relaxation Oscillator - A Triangular - wave Relaxation Oscillator - Active Filters(First order only) - Low – Pass Filter - High – Pass Filter - Band – Pass Filter	6	Lecture ,Group discussion, ICT and Assignment
UNIT III	Types of registers-Serial in-Serial Out-Serial in Parallel- Out-Parallel in-Serial Out- Parallel in- Parallel Out	9	Lecture & ICT
	Asynchronous Counters- Decoding Gates-Synchronous Counter (using 3 bit only)- Changing the Counter Modulus (using Mod 3 only) -Decade counter (using Mod 5 only).	9	Lecture & ICT
UNIT IV	Variableresistor networks-Binary Ladder	5	Lecture , ICT and Group discussion
	D/A converters-D/A accuracy and resolution.- A/D converter-	6	Lecture , ICT and seminar

	simultaneous conversion – counter method–		
	Continuous A/D conversion-A/D Techniques Dual slope A/D conversion-A/D accuracy and resolution.	7	Lecture ,seminar and Assignment
UNIT V	Multiplexers- Demultiplexers- 1-of -16 Decoder-	6	Lecture , ICT and seminar
	BCD to Decimal Decoder- Seven segment Decoders- Encoders -	6	Lecture , ICT and Assignment
	Exclusive OR Gates- Parity Generators and Checkers- Magnitude comparator.	6	Lecture ,Group discussion and Assignment

Course Outcomes (Cos)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	4	4	3	4	3	4	4	4	3.7
CO2	4	4	3	4	4	4	4	3	4	4	3.8
CO3	4	4	3	4	4	3	4	3	4	4	3.7
CO4	4	3	4	3	4	4	3	4	4	4	3.7
CO5	4	4	3	4	4	4	4	3	4	4	3.8
Mean Overall Score											3.74

Result: The Score for this Course is 3.74 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = <u>Total Values</u> Total No. of Pos & PSOs	Mean Overall Score of COs = <u>Total of Mean scores</u> Total No. of COs

<u>ASSESSMENT RUBRICS</u>

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 (Remembering/Recalling)	20%	20%
K2 (Understanding/Comprehension)	20%	20%
K3 (Application & Analysis)	30%	30%
K4 (Synthesis & Evaluation)	30%	30%

Course Designer:

1.DR. N.NAGARANI

2.DR.G.KRISHNA BAMA

Programme : M.Sc. **DSEC- I**
Semester : I **Hours : 5 P/W 75Hrs P/S**
Sub. Code : P22DSP1A **Credits : 4**

TITLE OF THE PAPER: MICROPROCESSOR AND MICROCONTROLLER

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL	ICT
	5	2	1	1	1

PREAMBLE: To understand the basics, internal architecture, languages, instruction sets and operations involved in microprocessors and microcontroller. To describe counters using time delay, programmable peripheral interface, and basic concepts of serial I/O and data communication and to develop programming skill.

COURSE OUTCOME At the end of the semester, the students will be able to	Unit	Hrs P/S
CO1:list the basics of microprocessor 8085, architecture, memory and input/output	I	15
CO2: classify the languages and instruction sets in microprocessor and design a counter with time delay using subroutine and develop programming skill	II	15
CO3: discuss the interfacing of microprocessor	III	15
CO4: know the basics of microprocessor 8086	IV	15
CO5:discuss about the microcontroller	V	15

SYLLABUS

UNIT I: MICROPROCESSOR ARCHITECTURE AND MICROCOMPUTER SYSTEMS

Microprocessor Architecture and its operations-Microprocessor initiated operations and 8085 Bus organization - Internal Data operations and the 8085 registers -Peripheral or Externally initiated operations - Memory - Flip flop or Latch as a storage element - Memory map and Addresses - Memory Address Range of a 1K memory chip - Memory address lines - Memory word size - Memory and Instruction Fetch - Memory classification - Example of a Microcomputer system.

UNIT II : INTRODUCTION TO 8085 ASSEMBLY LANGUAGE PROGRAMMING

Machine language - 8085 Machine language - 8085 Assembly langugae - Writing and Executing an Assembly language Program - Instruction classification - The 8085 Instruction set - Instruction, Data format and storage - Instruction word size - Opcode format - Data Format - Looping, counting, and indexing - Counters and Time delays - Time delay using one register - Stack - Subroutine - Subroutine Documentation and Parameter passing.

UNIT III : INTERFACING OF MICROPROCESSOR 8085

Basic concepts of programmable device – 8255 Programmable Peripheral Interface (PPI) – interface of ADC and DAC – 8237 Direct Memory Access (DMA) controller – Basic concepts of serial

I/O and data communication – interface of 8251 Universal Synchronous Aynchronous Receiver Transmitter (USART)

UNIT IV : MICROPROCESSOR 8086

Intel 8086 microprocessor – Introduction – Architecture – Pin configuration – Operating modes – Minimum mode – Maximum mode – Interrupts– The 8085 interrupt – RST 7.5,6.5,and 5.5 – Restart as software instructions.

UNIT V: MICROCONTROLLER 8051 ARCHITECTURE AND PROGRAMMING

Intel 8051 microcontrollers - Microcontrollers and embedded systems - Data transfer (copy) operations - Addressing Modes - Arithmetic operations - Addition - Subtraction - Logic operations - Logic AND – OR,Exclusive –OR, and NOT - Branch operations - Unconditional Jump - Conditional Jumps.

TEXT BOOK:

Microprocessor Architecture program and Application with the 8085 - Ramesh S.Gaonkar, 5th Edition, Penram International Publishing Pvt Ltd, 2013.

Unit I: **Ch. 3**(Sec.3.1 , 3.1.1 , 3.1.2 , 3.1.3 , 3.2 , 3.2.1 - 3.2.7 , 3.4)

Unit II : **Ch.1 ,2, 7, 8, & 9**(Sec.1.2.1 , 1.2.2 , 1.2.3, 1.2.5, 2.2 , 2.2.1, 2.3 , 2.3.1, 2.3.2, 2.3.3 , 7.1.,7.1.1.,7.1.2.,8.1.,8.1.1., 9.1.,9.2.,9.2.2.)

Unit III : **Ch.15 & 16**(Sec. 15.1., 15.1.1.,15.1.2., 15.1.3.,15.6.,15.6.1.,16.1.,16.1.1.,16.1.2.,16.1.3., 16.1.4.,16.1.5.,16.4.,16.4.1.

Unit IV: **Ch.12&18**(Sec. 18.2.,18.2.1.,18.2.2.,18.3.,18.3.1.,12.1.,12.1.1.,12.2.2.,12.3.,12.3.1.)
Unit V :**Ch.6& 18**(Sec.18.5.,18.5.1.,18.5.5.,6.1.,6.1.1.,6.2.,6.2.1.,6.2.3.,6.3.,6.3.1.,6.3.3.,6.4., 6.4.1.,6.4.3.)

REFERENCE BOOKS:

1. Microprocessor and its applications, - B.Ram, DhanpatRai publications.
2. Introduction to Microprocessors - Aditya P.Mathur, 2nd Edition, Tata Mc Graw Hill Ltd, 1985.
3. The Intel Microprocessor Architecture Programming and Interfacing - Barry B.Bray, 8th Edition, Dorling kindersley (India) Pvt. Ltd, Pearson Education, 2009

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I	Microprocessor Architecture and its operations-Microprocessor initiated operations and 8085 Bus organization- Internal Data operations and the 8085 registers	5	Lecture , peer teaching,GD&ICT
	Peripheral or Externally initiated operations - Memory - Flip flop or Latch as a storage element - Memory map and Addresses	5	Lecture , peer teaching,GD& ICT

	Memory Address Range of a 1K memory chip - Memory address lines - Memory word size - Memory and Instruction Fetch - Memory classification - Example of a Microcomputer system	5	Lecture , peer teaching,GD& ICT
UNIT II	Machine language - 8085 Machine language - 8085 Assembly language - writing and Executing an Assembly language Program	5	Lecture , peer teaching,GD& ICT
	Instruction classification - The 8085 Instruction set - Instruction, Data format and storage - Instruction word size - Opcode format - Data Format	5	Lecture , peer teaching,GD& ICT
	Looping, counting, and indexing - Counters and Time delays - Time delay using one register - Stack - Subroutine - Subroutine Documentation and Parameter passing	5	Lecture , peer teaching,GD& ICT
UNIT III	Basic concepts of programmable device – 8255 Programmable Peripheral Interface (PPI)	5	Lecture , peer teaching,GD& ICT
	interface of ADC and DAC – 8237 Direct Memory Access (DMA) controller	5	Lecture , peer teaching,GD& ICT
	Basic concepts of serial I/O and data communication – interface of 8251 Universal Synchronous Aynchronous Receiver Transmitter (USART)	5	Lecture , peer teaching,GD& ICT
UNIT IV	Intel 8086 microprocessor – Introduction – Architecture	5	Lecture , peer teaching,GD& ICT
	Pin configuration – Operating modes – Minimum mode – Maximum mode	5	Lecture , peer teaching,GD& ICT
	The 8085 interrupt – RST 7.5,6.5,and 5.5 – Restart as software instructions	5	Lecture , peer teaching,GD& ICT
UNIT V	Intel 8051 microcontrollers - Microcontrollers and embedded systems -	5	Lecture , peer teaching,GD& ICT
	Data transfer (copy) operations - Addressing Modes - Arithmetic operations - Addition - Subtraction	5	Lecture , peer teaching,GD& ICT
	Logic operations - Logic AND – OR,Exclusive –OR, and NOT - Branch operations - Unconditional Jump - Conditional Jumps	5	Lecture , peer teaching,GD& ICT

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	3	3	3	4	3	4	3	3	3	5	3.4
CO2	3	4	3	4	3	4	3	3	3	5	3.5

CO3	3	3	4	4	4	4	3	3	3	5	3.6
CO4	3	3	3	4	3	4	3	3	3	5	3.4
CO5	3	3	3	4	3	4	3	3	3	5	3.4
Mean Overall Score											3.46

Result: The Score for this Course is 3.46 (High Relationship)

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

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 – Remembering/Recalling	20%	20%
K2 – Understanding /Comprehension	20%	20%
K3 – Application and Analysis	30%	30%
K4 – Synthesis and Evaluation	30%	30%

Course Designer: Dr. G.Selvarani Department of Physics

Programme : M.Sc. **DSEC I**
Semester : I **Hours : 5 P/W 75Hrs P/S**
Sub. Code : P22DSP1B **Credits : 4**

TITLE OF THE PAPER: MICROPROCESSOR AND EMBEDDED MICROCONTROLLER

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL	ICT
	5	2	1	1	1

PREAMBLE: To acquire an extensive knowledge about the architecture and assembly language programming of microprocessors 8085, microcontroller 8051 and embedded micro controller. It also explains interfacing memory and I/O devices.

COURSE OUTCOME At the end of the semester, the students will be able to	Unit	Hrs P/S
CO1:understandthe architecture of microprocessor 8085 and its timing diagramarchitecture, memory and input/output	I	15
CO2: describe the memory interface and input/output	II	15
CO3: discuss about the microcontroller	III	15
CO4: enhance the knowledge about microcontroller	IV	15
CO5: apply the concepts of microprocessor and microcontroller in the field of communication and industry	V	15

SYLLABUS

UNIT I: 8085 ARCHITECTURE AND PROGRAMMING 8085

Architecture - Programmer's model - ALU - Registers and Flags - Stacks - Complete instruction set of Intel 8085 - State transition and timing diagrams - T States - Machine cycles - Instruction cycles - Timing diagram for memory read and memory write cycles - Addressing modes - Maskable and Non-maskable Interrupts - Assembly language programs – time delay subroutines and delay calculations.

UNIT II: INTERFACING MEMORY AND I/O DEVICES

Interfacing memory and devices – I/O and Memory mapped I/O – Simple polled I/O and Handshaking operations - Programmable keyboard / display interface 8279 - Programmable peripheral device 8255A - 8253 Timer Interface – DAC and ADC interface - Wave form generation (Sine, square, triangular and ramp wave) - Programmable communication interface 8251 (USART).

UNIT III: MICROCONTROLLER 8051

Introduction – 8 and 16 bit Microcontroller families –Flash series – Embedded RISC Processor – 8051 Microcontroller Hardware – Internal registers – Addressing modes – Assembly Language Programming – Arithmetic, Logic, Sorting operations and BCD to binary and binary to BCD conversion.

UNIT IV: INTERFACING I/O AND MEMORY WITH 8051

Interfacing I/O Ports, External memory, counters and Timers - Serial data input/output, Interrupts – Interfacing 8051 with ADC, DAC, LED display, Keyboard, Sensors and Stepper motor.

UNIT V: EMBEDDED MICROCONTROLLER

Embedded microcontroller system – types of embedded operating system – Micro chip PIC 16C6X /7X family – features – Architecture – Memory Organization – Register file map – I/O ports – Data and flash program memory – asynchronous serial port – Applications in communication and industrialcontrols

BOOKS FOR STUDY:

1. Microprocessor Architecture, programming and Application with the 8085 - R.S. Gaonkar, 3 rd Edition, Penram International Publishing, Mumbai,1997.

2. The 8051 Micro Controller Architecture, Programming and Applications -Kenneth J. Ayala, 3rd Edition , PenramInternational

3. Introduction to Embedded System - K. V. Shibu, Tata Mc Graw-Hill Education Private Ltd., NewDelhi.

BOOKS FOR REFERENCE:

1. Fundamentals of Microprocessors and Microcomputers - B. Ram, Dhanpat Rai publications, New Delhi.

2. Microprocessor and its applications - R. Thiagarajan, S. Dhanasekaran, S.Dhanapal, New Age International, NewDelhi.

3. The 8051 Microcontroller and Embedded Systems - Muhammed Ali Mazidi,JaniceGillespie Mazidi,, Fourth Indian Reprint, Pearson Education ,2004.

4. Introduction to Embedded Systems - Raj Kamal, TMS,2002

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I	Architecture - Programmer's model - ALU - Registers and Flags - Stacks - Complete instruction set of Intel 8085.	5	Lecture , peer teaching,GD&ICT
	State transition and timing diagrams - T States - Machine cycles - Instruction cycles - Timing diagram for memory read and memory write cycles.	5	Lecture , peer teaching,GD& ICT
	Addressing modes - Maskable and Non-maskable Interrupts - Assembly language programs – time delay subroutines and delay calculations.	5	Lecture , peer teaching,GD& ICT
UNIT II	Interfacing memory and devices – I/O and Memory mapped I/O – Simple polled I/O and Handshaking operations	5	Lecture , peer teaching,GD& ICT
	Programmable keyboard / display interface 8279 - Programmable peripheral device 8255A - 8253 Timer Interface – DAC and ADC interface	5	Lecture , peer teaching,GD& ICT
	Wave form generation (Sine, square, triangular and ramp wave) - Programmable communication interface 8251 (USART).	5	Lecture , peer teaching,GD& ICT
UNIT III	Introduction – 8 and 16 bit Microcontroller families –Flash series – Embedded RISC Processor	5	Lecture , peer teaching,GD& ICT
	8051 Microcontroller Hardware – Internal registers – Addressing modes – Assembly Language Programming.	5	Lecture , peer teaching,GD& ICT

	Arithmetic, Logic, Sorting operations and BCD to binary and binary to BCD conversion.	5	Lecture , peer teaching,GD& ICT
UNIT IV	Interfacing I/O Ports, External memory, counters and Timers	5	Lecture , peer teaching,GD& ICT
	Serial data input/output, Interrupts – Interfacing 8051 with ADC, DAC	5	Lecture , peer teaching,GD& ICT
	LED display, Keyboard, Sensors and Stepper motor.	5	Lecture , peer teaching,GD& ICT
UNIT V	Embedded microcontroller system – types of embedded operating system	5	Lecture , peer teaching,GD& ICT
	Micro chip PIC 16C6X /7X family – features – Architecture – Memory Organization	5	Lecture , peer teaching,GD& ICT
	Register file map – I/O ports – Data and flash program memory – asynchronous serial port – Applications in communication and industrialcontrols	5	Lecture , peer teaching,GD& ICT

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	3	3	3	4	3	4	3	3	3	5	3.4
CO2	3	4	3	4	3	4	3	3	3	5	3.5
CO3	3	3	4	4	4	4	3	3	3	5	3.6
CO4	3	3	3	4	3	4	3	3	3	5	3.4
CO5	3	3	3	4	3	4	3	3	3	5	3.4
Mean Overall Score											3.46

Result: The Score for this Course is 3.46 (High Relationship)

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

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 – Remembering/Recalling	20%	20%
K2 – Understanding /Comprehension	20%	20%
K3 – Application and Analysis	30%	30%
K4 – Synthesis and Evaluation	30%	30%

Course Designer: Dr. G.Selvarani Department of Physics

Programme : M.Sc., PHYSICS **Part III: SEC-I**
Semester : I **Hours : 2 P/W 30Hrs P/S**
Sub. Code : P22SEP1 **Credits : 2**

TITLE OF THE PAPER: SOLAR ENERGY AND ITS APPLICATIONS

Pedagogy	Hours	Lecture	Peer Discussion/Teaching	GD/VIDOES/TUTORIAL	ICT
	2	1	1/2	1/2	1

PREAMBLE:
To impart fundamental aspects of solar energy utilization. To provide an introductory account about the solar collectors, solar heaters and and to design simple solar cell.
To become a self-secured.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: Impart the knowledge of Solar energy measuring instruments.	I	6 hrs
CO2: Impart the knowledge of understanding the function of solar collectors.	II	6 hrs
CO3: Impart the knowledge of application of solar energy Heaters.	III	6 hrs
CO4: Impart the knowledge of solar energy to produce Hydrogen.	IV	6 hrs
CO5: Impart the knowledge about, how to design simple solar cells.	V	6 hrs

SYLLABUS

Unit I: Solar Energy Measuring Instruments:
Introduction – Classification – Angstrom Compensation Pyroheliometer – Sun-Shine Recorder – Solar Radiation Data – Estimation of Average Solar Radiation

Unit II: Solar Collectors :
Introduction – The General Description of Flat-plate Collectors – Typical liquid collector – Typical Air Collector - The General Characteristics of Flat-plate Collectors.

Unit III : Solar Heaters :
Introduction - Types of Solar Water Heaters – Design of Heating System for a Building.

Unit IV: Solar Production of Hydrogen :
Introduction – Methods of Production of Hydrogen.

Unit V: Simple Design of Solar Panel.
Introduction – Requirements - Procedure to Design the Solar Panel.

Text Book:

Solar Energy Utilization – G.D.RAI, KHANNA PUBLISHERS, DELHI- 110006.Fifth Edition, Fourth Reprint 2001.

1. Unit I : Chapter : 4 (Sec:- – 4.1, 4.2, 4.4, 4.5 and 4.6).

2. Unit II : Chapter : 5 (Sec:- – 5.1, 5.3 and 5.5).
3. Unit III : Chapter : 11 (Sec:- 11.1, 11.2 and 12.7)
4. Unit IV : Chapter : 16 (Sec:- 16.7)
5. Unit V : https://www.instructables.com

Reference Book:

Solar Energy Principles of Thermal Collection and Storage – Suhas P Sukhatme, TMH Publications, New Delhi, Second Edition .

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
Unit I	Introduction – Classification – Angstrom Compensation Pyroheliometer.	**3 hrs**	Motivation by asking questions – peer group discussion and by demonstrating through ICT.
	Sun-Shine Recorder – Solar Radiation Data – Estimation of Average Solar Radiation.	**3 hrs**	peer group discussion and by demonstrating through ICT.
Unit II	Introduction – The General Description of Flat-plate Collectors – Typical liquid collector.	**3 hrs**	Motivation by asking questions – peer group discussion and by demonstrating through ICT.
	Typical Air Collector - The General Characteristics of Flat-plate Collectors.	**3 hrs**	peer group discussion and by demonstrating through ICT.
Unit III	Introduction - Types of Solar Water Heaters .	**3 hrs**	Motivation by asking questions – peer group discussion and by demonstrating through ICT.
	Design of Heating System for a Building.	**3 hrs**	peer group discussion and by demonstrating through ICT.
Unit IV	Introduction – Methods of Production of Hydrogen.	**6 hrs**	Motivation by asking questions – peer group discussion and by demonstrating through ICT.
Unit V	Introduction – Requirements - Procedure to Design the Solar Panel.	**6 hrs**	Motivation by asking questions – peer group discussion and by demonstrating through ICT.

Cours e Out	**Programme Outcomes (POs)**	**Programme Specific Outcomes (PSOs)**	**Mean scores of Cos**

comes (COs)	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	3	3	3	3	4	4	3	3	3.3
CO2	3	3	4	4	3	3	3	3	3	4	3.3
CO3	3	4	3	3	3	4	3	4	3	3	3.3
CO4	3	3	3	4	3	4	3	4	3	3	3.3
CO5	4	3	4	4	4	3	4	4	4	3	4.0
Mean Overall Score											3.5

Result: The Score for this Course is **3.5** (High Relationship)

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

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 – Remembering/Recalling	20%	20%
K2 – Understanding /Comprehension	20%	20%
K3 – Application and Analysis	30%	30%
K4 – Synthesis and Evaluation	30%	30%

Course Designer : **Dr. Mrs. SANTHI.** Department of PHYSICS

Programme : M. Sc.
Semester : I
Sub. Code : P22CP4P

Part III : Core - IV
Hours : 6 Hrs P/W 90 Hrs P/S
Credits : 3

TITLE OF THE PAPER : PHYSICS PRACTICAL - I

Pedagogy	Hours	Lab Experimentation	Peer Teaching	TUTORIAL	ICT
	6	3	1	1	1

PREAMBLE : The purpose of the course is to make the students to develop their skills in doing non electronics practical and to make them to determine and analyze physical parameters.

COURSE OUTCOME

At the end of the Semester, the Students will be able to

CO1 : acquire knowledge about the usage of electronic and non-electronic devices .

CO2 : determine various physical parameters

CO3 : construct different types of bridges and circuits.

CO4 : analyze Hartmann's interpolation formulae, self and mutual inductance , refractive index of various prisms , first and second order spectrum.

CO5 : develop their skills in handling the instruments

S.NO	EXPERIMENT
1	Mutual inductance determination by Maxwell's bridge
2	Self inductance determination by Owen's bridge
3	Boltzmann's constant determination for various types of diodes
4	Planck's constant determination and verification of Planck's inverse square law using photosensitive device
5	Determination of Sodium D-lines using spectrometer
6	Refractive index determination of glass prism using spectrometer at minimum deviation position
7	Refractive index determination of hollow glass prism using spectrometer at minimum deviation position
8	Determination of Hartmann's constants by interpolation formula using spectrometer
9	Determination of resolving power of the Telescope
10	Determination of wavelength of I and II order spectral lines using grating by normal incidence method

Course Designer **: Dr. J.S.P. CHITRA** , Department of PHYSICS

Programme : M.Sc.
Semester : II
Sub. Code : P22CP5

Core - V
Hours : 6 Hrs P/W 90Hrs P/S
Credits : 4

TITLE OF THE PAPER: MATHEMATICAL PHYSICS - II

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL	ICT
	6	3	1	2	-

PREAMBLE: The student shall have gained a broad knowledge of the scientific theories and methods of her field of study and they know how to apply her knowledge on new subject areas within Mathematics and physics.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: analyze differential equations	I	18
CO2: predict the partial differential equations	II	18
CO3: define tensor analysis	III	18
CO4: apply the complex variable	IV	18
CO5: solve the problems using integral transforms	V	18

SYLLABUS

UNIT I : DIFFERENTIAL EQUATIONS

Legendre equation – Generating function Pn(X) – Orthogonality of functions - Orthogonality of Legendre's polynomials – recurrence relations for Pn(X) – Bessel's differential equations – Bessel's functions of the third kind (Hankel function) – Generating function for Jn(X) - Recurrence relation for Jn(X) – Orthogonality of Bessel's functions

UNIT II : PARTIAL DIFFERENTIAL EQUATIONS

Introduction - Partial differential equation in Physics – Laplace's equation in 3 dimension and its solutions - wave equation in three dimension and its solutions - Green's function - Solution of Poisson's equation using Green's function

UNIT III : TENSOR ANALYSIS

Definition of Tensors – Contravariant, covariant and mixed tensors – addition and subtraction of Tensors – Summation convention- Symmetry and Anti-symmetry Tensor – Contraction and direct product – Quotient rule- Pseudo tensors, Levi-Civita Symbol - Dual tensors, irreducible tensors-Metric tensors-Christoffel symbols – Geodesics.

UNIT IV : COMPLEX VARIABLE

Functions of complex variable-Analytic functions-Cauchy- Riemann equations- integration in the Complex plane-Cauchy's theorem- Cauchy's integral formula-Taylor and Laurent expansions-Singular Points.

UNIT V: INTEGRAL TRANSFORMS

Fourier transforms - cosine and sine transforms - Linearity theorem - Parseval's theorem - solution of differential equation. Laplace transforms - Definition - Linearity, shifting and change of scale properties. Inverse Laplace transforms – Definition - Problems

TEXT BOOK:

1.Mathematical Physics - S.L. Kakani ,C.Hemrajani. II Edition CBS Publishers &Distributors Pvt.. LTD., 2010.

Unit - I Ch.7 (sec. 7.1 ,7.5 ,7.7)

Unit - II Ch.9(sec. 9.1 –9.4, 9.9 ,9.10)

Unit – III Ch. 3(3.1- 3.15 ,3.18 ,3.19 ,3.22-3,24)
Unit - IV Ch. 6 (sec. 6.1 –6.9,6.11, 6,13, 6.14)
Unit - V Ch.8 (sec. 8.1, 8.2, 8.4, 8.9 -8.12)

REFERENCES:

1. B. D. Gupta, Mathematical Physics 4th edition Vikas Publishing House Pvt Ltd reprint 2013
2. Suresh Chandra, Mohitkumar Sharma, An Introduction to Mathematical Physics Narosa Publishing House 2013.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I	Legendre equation – Generating function Pn(X) – Orthogonality of functions - Orthogonality of Legendre's polynomials	6	Lecture & Tutorial
	recurrence relations for Pn(X) – Bessel's differential equations – Bessel's functions of the third kind	6	Lecture & Tutorial
	Generating function for Jn(X) - Recurrence relation for Jn(X) – Orthogonality of Bessel's functions	6	Lecture & Tutorial
UNIT II	- Partial differential equation in Physics – Laplace's equation in 3 dimension and its solutions	6	Lecture & Tutorial
	wave equation in three dimension and its solutions - Green's function -	6	Lecture & Tutorial
UNIT III	Definition of Tensors – Contravariant, covariant and mixed tensors – addition and subtraction of Tensors – Summation convention-	6	Lecture & Tutorial
	Symmetry and Anti-symmetry Tensor – Contraction and direct product – Quotient rule- Pseudo tensors	6	Lecture & Tutorial
	Levi-Civita Symbol - Dual tensors, irreducible tensors- Metric tensors-Christoffel symbols – Geodesics	6	Lecture & Tutorial
	Functions of complex variable- Analytic functions-Cauchy-Riemann equations- integration in the Complex plane	8	Lecture & Tutorial
	Cauchy's theorem- Cauchy's integral formula-	6	Lecture & Tutorial

UNIT IV	Taylor and Laurent expansions- Singular Points-	4	Lecture & Tutorial
UNIT V	Fourier transforms - cosine and sine transforms - Linearity theorem - Parseval's theorem - solution of differential equation	4	Lecture & Tutorial
	Laplace transforms - Definition - Linearity, shifting and change of scale properties.	4	Lecture & Tutorial
	Inverse Laplace transforms – Definition - Problems	10	Lecture & Tutorial

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	3	4	4	4	3	3	3	5	3.6
CO2	5	3	4	4	5	3	3	4	3	4	3.8
CO3	3	3	4	3	3	3	5	4	3	3	3.4
CO4	3	3	4	3	3	3	5	4	3	4	3.5
CO5	4	3	3	4	4	3	3	5	4	3	3.6
Mean Overall score											3.58

Result: The Score for this Course is 3.58 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value / Total No. of Pos& PSOs			Mean Overall Score of COs = Total of Mean Score / Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1:REMEMBERING/RECALLING.	20%	20%
K2: UNDERSTANDING / COMPREHENSION.	20%	20%
K3: APPLICATION AND ANALYSIS.	30%	30%

K4: SYNTHESIS AND EVALUATION.	30%	30%

Course Designer **: Dr. G. SAROJA** , Department of PHYSICS

Programme : M.Sc., PHYSICS **Part III: MAJOR Core**
Semester : II **Hours : 6 P/W 90Hrs P/S**
Sub. Code : P22CP6 **Credits : 5**

TITLE OF THE PAPER: QUANTUM MECHANICS- I

Pedagogy	Hours	Lecture	Peer	GD/VIDOES/TUTORIAL	ICT

			Discussion/Teaching		
	6	3	1	1	1

PREAMBLE: Understanding the postulates of Quantum Mechanics, admissible conditions on the Wave functions, and trial function linear in variational parameter and Hydrogen molecule with perturbation theory.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: Study the fundamentals of wave mechanics. List the Bohr's postulates and exhibit the main characteristics features of quantum system with the aid of simple examples and to show how these features arise from the conditions on the Schrodinger wave function.	I	18 hrs
CO2: Study the stationary state and Eigen spectrum of systems using time dependent Schrodinger equation.	II	18 hrs
CO3: Solve the exactly soluble Eigen value problems.	III	18 hrs
CO4: Know the matrix formulation of quantum theory and how it can be used to understand the equation of motion. Know quantum states, the Hilbert space of state vectors and wave functions, degeneracy and transformations and symmetries.	IV	18 hrs
CO5: Understand the theory of identical particles and Angular momentum. To obtain spin angular momentum and Clebsch –Gordan Coefficients.	V	18 hrs

SYLLABUS

UNIT-I: FOUNDATIONS OF WAVE MECHANICS:

Introduction – Wave Nature of Particles (Matter Waves) – The Uncertainty Principle (Brief Introduction) - The Principle of Superposition – Wave Pocket – Time Dependent 1D Schrodinger equation for a free particle - Interpretation of the wave function – Probability Interpretation – Probability Current Density – Expectation Value - Ehrenfest's theorem - Admissibility Condition on the Wave Function.

Linear Vector Space – Linear Operators (Brief Introduction) – Hilbert Space (Definition) - Eigen Functions And Eigen Values – Hermitian Operator - Postulates of Quantum Mechanics – Dirac's Notation .

UNIT-II: STATIONARY STATE AND ENERGY SPECTRA:

Introduction – Stationary states - Time independent Schrodinger equation - A Particle in a Square well Potential – Bound states in a Square well – Square Potential Barrier (Quantum Mechanical Tunnelling) – System of identical particles – Interchange of Particles; Symmetric and antisymmetric wave functions – Spin and Statistics (Brief Explanation).

UNIT-III: EXACTLY SOLUBLE EIGENVALUE PROBLEMS:

Introduction – The Simple Harmonic Oscillator – The Schrodinger Equation for One dimensional Linear Harmonic Oscillator – Properties of Stationary States- The Angular Momentum Operators - Stationary State Wave Functions – The Hydrogen Atom – Stationary State Wave Functions..

UNIT-IV: MATRIX FORMULATION OF QUANTUM THEORY, EQUATION OF MOTION & ANGULARMOMENTUM:

Introduction - Quantum States; State Vectors and Wave Functions – The Hilbert Space of State Vectors; Dirac Notation , Bra Vectors, Ket Vectors – Symmetries and Conservation Laws.

Angular Momentum

Introduction – The Eigenvalue Spectrum - Matrix representation of J in the |jm> Basis -Spin

Angular Momentum – Addition of Angular Momenta – Clebsch - Gordan coefficients.

UNIT-V: SCATTERING THEORY:

Introduction - Kinematics of Scattering Process: Differential and Total Cross- Sections - Wave Mechanical Picture of scattering: The Scattering Amplitude – The Born Approximation and its Validity –Born Series .

Partial Wave Analysis

Introduction - Asymptotic behavior of Partial Waves: Phase Shift – The Scattering Amplitude in terms of Phase Shifts – The Differential and Total Cross Sections: Optical Theorem .

BOOKS FOR STUDY:

1. **Quantum Mechanics** – G. Aruldhas, SECOND EDITION Prentice Hall of India Pvt. Ltd., Delhi -92, **2009.**

   UNIT-I: CHAPTER 2 & 3 (Sec : - 2.1 – 2.7 & 2.10 AND 3.1 – 3.5 & 3.8).

2. **A Text book Of Quantum Mechanics** -SECOND EDITION , P.M. Mathews and K.Venkatesan, McGraw Hill Education (India) Pvt. Ltd., **2014.**

   UNIT-II: CHAPTER 2C & 3 (Sec :- 2.9 – 2.13 and 3.16).

   UNIT-III: CHAPTER 4:- 4A (Sec :- 4.1 – 4.3, 4.6, 4.16 AND 4D-4.16).

   UNIT-IV: CHAPTER 7 & 8 (Sec:- 7.1 -7.2, 7.12 AND 8.1 – 8.3 , 8.5 & 8.6).

   UNIT-V: CHAPTER 6 (Sec :- 6.1, 6.2, 6.4, 6.5 & 6.8 - 6.10).

BOOKS FOR REFERENCE:

1. **Quantum Mechanics** – Theory and applications - A. K. Ghatak and Lokanathan, Macmillan India Ltd Publication, Fifth Edition,**2015.**
2. **Quantum Mechanics** - Leonard I. Schiff, McGraw-Hill International Publication, Third Edition,**1968.**
3. **Quantum Mechanics** - V. K. Thankappan, New Age International (P) Ltd. Publication, Second Edition,**2003.**
4. **QuantumMechanics**-E.Merzbacher,JohnWileyIntersciencePublications,Third Edition,**2011.**
5. **Quantum Mechanics (Vol .I)** - Claude Cohen-Tannoudji, Bernard Diu, Franck Laloë, JohnWiley Interscience Publications, First Edition,**1991.**
6. **Quantum Mechanics** - Pauling &Wilson, Dover Publications, New Edition,**1985.**
7. **Principle of Quantum Mechanics** - R. Shankar, Plenum US Publication, Second Edition, **1994.**

Web REFERENCE:

1. http://physics .mq.edu.au/~jcresser/phys304/Handouts/QuantumPhysicsNotes.pdf
2. http://quantumphysics.iop.org

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
	Introduction – Wave Nature of Particles (Matter Waves) – The	**4hrs**	Motivation by asking questions – peer group discussion and by lecturing through ICT (power

UNIT I	Uncertainty Principle (Brief Introduction) - The Principle of Superposition		point presentation)
	Wave Pocket – Time Dependent 1D Schrodinger equation for a free particle - Interpretation of the wave function	**5hrs**	Lecturing – deriving the condition by group discussion.
	Probability Interpretation – Probability Current Density – Expectation Value - Ehrenfest's theorem - Admissibility Condition on the Wave Function.	**5hrs**	Peer group teaching and lecturing.
	Linear Vector Space – Linear Operators (Brief Introduction) – Hilbert Space (Definition) - Eigen Functions And Eigen Values – Hermitian Operator - Postulates of Quantum Mechanics – Dirac's Notation .	**4hrs**	Lecturing with discussion and deriving the expression along with example problems.
UNIT II	Introduction – Stationary states - Time independent Schrodinger equation	**5 hrs**	Lecturing – deriving the expression by group discussion.
	A Particle in a Square well Potential – Bound states in a Square well	**4 hrs**	Lecturing – deriving the theorem by group discussion.
	Square Potential Barrier (Quantum Mechanical Tunnelling) – System of identical particles	**4 hrs**	Lecturing – deriving the expression by group discussion.
	Interchange of Particles; Symmetric and antisymmetric wave functions – Spin and Statistics (Brief Explanation).	**5 hrs**	Lecturing – deriving the expression by group discussion.

UNIT III	Introduction – The Simple Harmonic Oscillator	**5 hrs**	Motivation by asking questions – peer group discussion and by lecturing through ICT (power point presentation)
	The Schrodinger Equation for One dimensional Linear Harmonic Oscillator	**4 hrs**	Lecturing – by group discussion and emphasizing the importance of Schrodinger Equation .
	Properties of Stationary States	**4 hrs**	Peer group teaching and discussion.
	The Angular Momentum Operators	**3 hrs**	Lecturing with discussion .
	Stationary State Wave Functions	**2 hrs**	Lecturing – deriving the expression by group discussion.
	Introduction - Quantum States; State Vectors and Wave Functions – The Hilbert Space of State Vectors- The Hydrogen Atom – Stationary State wave Functions.	**5hrs**	Motivation by asking questions – peer group discussion and by lecturing through ICT (power point presentation)
UNIT IV	Dirac Notation , Bra Vectors, Ket Vectors – Symmetries and Conservation Laws.	**4hrs**	Lecturing and explaining by group discussion.
	Angular Momentum Introduction – The Eigenvalue Spectrum - Matrix representation of J in the |jm> Basis - Spin Angular Momentum	**4hrs**	Peer group discussion and lecturing.
	Addition of Angular Momenta – Clebsch - Gordan coefficients.	**5hrs**	Lecturing with discussion and expressing the essential features of Clebsch - Gordan coefficients.
	Introduction - Kinematics of Scattering Process: Differential and Total Cross- Sections - Wave Mechanical Picture of	**5 hrs**	Motivation by asking questions – peer group discussion and by lecturing through ICT (power point presentation)

UNIT V	scattering:		
	The Scattering Amplitude – The Born Approximation and its Validity –Born Series .	**4 hrs**	Lecturing – deriving the expression by group discussion
	Partial Wave Analysis Introduction - Asymptotic behavior of Partial Waves: Phase Shift	**4 hrs**	Peer group discussion and deriving the expression
	The Scattering Amplitude in terms of Phase Shifts – The Differential and Total Cross Sections: Optical Theorem .	**5 hrs**	Lecturing with discussion.

Course Out comes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean scores of Cos**
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	3	3	3	3	4	4	3	3	3.3
CO2	3	3	4	4	3	3	3	3	3	4	3.3
CO3	3	4	3	3	3	4	3	4	3	3	3.3
CO4	3	3	3	4	3	4	3	4	3	3	3.3
CO5	4	3	4	4	4	3	4	4	4	3	3.7
Mean Overall Score											3.38

Result: The Score for this Course is **3.38** (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = <u>Total of Value</u>			Mean Overall Score of COs = <u>Total of Mean Score</u>		

Total No. of POs & PSOs	Total No. of COs

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1:REMEMBERING/RECALLING.	20%	20%
K2: UNDERSTANDING / COMPREHENSION.	20%	20%
K3: APPLICATION AND ANALYSIS.	30%	30%
K4: SYNTHESIS AND EVALUATION.	30%	30%

Course Designer : **Dr. Mrs. SANTHI.** Department of PHYSICS

Programme : M.Sc.
Semester : II
Sub. Code : P22CP7

PART III: CORE -VII
Hours : 5 P/W 75 Hrs P/S
Credits : 4

TITLE OF THE PAPER: ELECTROMAGNETIC THEORY

Pedagogy	Hours	Lecture	Peer Teaching	GD/ Videos/Tutorial	ICT
	5	2	1	1	1

PREAMBLE: To understand the basic principles of electrostatics and magneto statics and their applications and electromagnetic wave propagation.

COURSE OUTCOME At the end of the Semester, the students will be able to	**Unit**	**Hrs P/S**
CO 1 : understand the fundamental principles and laws of electrostatics and their applications	I	15
CO 2: know the principles of magnetostatics and their applications	II	15
CO 3: explain the phenomenon of electromagnetic induction and apply Maxwell's equations to specific physical situations	III	15
CO 4: acquire knowledge in deriving wave equations and discuss the propagation of electromagnetic wave in different media	IV	15
CO 5: discuss the importance of scalar and vector potentials	V	15

SYLLABUS

UNIT I - ELCTROSTATICS

Electric charge-Coulombs law -Electric field - Electrostatic potential- Gauss's Law-Applications of Gauss's Law-electric dipole-multipole expansion of electric fields- Poisson's equation - Laplace equation-Laplace equation in one independent variable-solutions to Laplace equation in spherical coordinates- Polarization -Field outside of a Dielectric medium -The electric field inside a dielectric- Gauss law in dielectric- The electric displacement – electric susceptibility and dielectric constant.

UNIT II - MAGNETOSTATICS

Magnetic Field-Magnetic induction- force on a current carrying conductor- Biot-Savart Law- Application of Biot-Savart Law-Ampere's circuital law - Magnetic vector potential-magnetic field of a distant circuit- Magnetic Scalar potential-magnetic flux-Magnetization –Magnetic field produced by magnetized material -Magnetic scalar potential and magnetic pole density..

UNIT III- ELECTRODYNAMICS AND CONSERVATIONS LAWS

Ohm'sLaw–electromotiveforce–motionalemf–Faraday'sLaw– The inducedelectricfield–Inductance– energy in magnetic fields – Electrodynamics before Maxwell – How Maxwell Fixed Ampere's law – Maxwell's equation-magnetic charge – Maxwell's equations in matter – boundary conditions. Charge and energy -The Continuity equation – Poynting's theorem.

UNIT - IV ELECTROMAGNETIC WAVES

Waves in one dimension: Wave equation – sinusoidal waves – boundary conditions - reflection and transmission – polarization. Electromagnetic waves in vacuum: Wave equation for **E** and **B** – monochromatic plane waves – energy and momentum in electromagnetic waves. Electromagnetic waves in matter: Propagation in linear media – reflection and transmission at normal incidence – reflection and transmission at oblique incidence. Absorption and dispersion: Electromagnetic waves in conductors – reflection at a conducting surface

UNIT - V GUIDED WAVES, POTENTIAL AND FIELDS

Guided waves: Wave guides - waves in a rectangular wave guide – coaxial transmission line. The potential formulation: Scalar and vector potentials - gauge transformations - Coulomb gauge and Lorenz gauge-Lorentz force law in potential form. Continuous distributions: Retarded potentials - Jefimenko's equations. -Point charges: Lienard-Wiechertpotentials

Books for Study :

1. Foundations of Electromagnetic theory,John R.Reitz, Fredrick J.Milford, Robert W.Christy,Third edition,Norosa Publishing House,New Delhi,1989.

   UNIT – I Ch.2 (2.1, 2.2, 2.3, 2.4, 2.6, 2.7, 2.8, 2.9, 3.1,3.2, 3.3, 3.4.4.1-4.5)

   UNIT – II Ch.8 (8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9,9.1,9.2,9.3)

2. Introduction to Electrodynamics, David J.GriffithsThird edition, PHI Learning Private Limited,2012.

   UNIT-III:Chapter7&8: (7.1.1-7.3.6, 8.1.1& 8.1.2)

   UNIT-IV:Chapter9: (9.1.1-9.4.2)

   UNIT-V:Chapter9&10 (9.5.1-9.5.3, 10.1.1-10.3.1)

BOOKSFORREFERENCE:

1. ElectromagneticTheoryandElectrodynamics,SathyaPrakash,KedarNath,Ram NathandCo,2017.
2. Electromagnetics,B.BLaud,WileyEasternCompany,2000.
3. FundamentalsofElectromagnetic,WazedMiah,TataMcGrawHill,1980.
4. BasicElectromagneticswithApplication,Narayanarao,(EEE)PrenticeHall,1997.
5. ClassicalElectrodynamics–J.D.Jackson,IIEdition,WileyEasternLimited,1993.
6. ElectromagneticFieldsandWaves–P.LorrainandD.Corson.
7. Electromagnetic,B.BLaud,WileyEasternCompany,2000.

Web Resources:

1. https://www.britannica.com/science/Coulomb-force
2. https://en.wikipedia.org/wiki/Gauss%27s_law
3. http://hyperphysics.phy-astr.gsu.edu/hbase/electric/laplace.html
4. https://www.electrical4u.com/biot-savart-law/
5. https://booksite.elsevier.com/9780444594365/downloads/16755_10027.pdf
6. https://www.electrical4u.com/faraday-law-of-electromagnetic-induction/
7. https://en.wikibooks.org/wiki/Electrodynamics/Maxwell%27s_Four_Equations

8. https://opentextbc.ca/universityphysicsv2openstax/chapter/maxwells-equations-and-electromagnetic-waves/ 9. https://www.allaboutcircuits.com/textbook/alternating-current/chpt-14/waveguides/

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I	Electric charge-Coulombs law - Electric field - Electrostatic potential-Gauss's Law-Applications of Gauss's Law-	5	Lecture ,ICT and Seminar
	electric dipole-multipole expansion of electric fields- Poisson's equation - Laplace equation-Laplace equation in one independent variable-solutions to Laplace equation in spherical coordinates-	5	Lecture ,ICT,Group Discussion and Assignment
	Polarization -Field outside of a Dielectric medium -The electric field inside a dielectric-Gauss law in dielectric- The electric displacement – electric susceptibility and dielectric constant pendulum	5	Lecture ,ICT, Group Discussion and seminar
UNIT II	Magnetic Field-Magnetic induction-force on a current carrying conductor-Biot-Savart Law-Application of Biot-Savart Law-Ampere's circuital law -	7	Lecture ,ICT and Seminar
	Magnetic vector potential-magnetic field of a distant circuit- Magnetic Scalar potential-magnetic flux-	4	Lecture ,ICT,Group Discussion.
	Magnetization –Magnetic field produced by magnetized material - Magnetic scalar potential and magnetic pole density	4	Lecture ,ICT,Group Discussion
UNIT III	Ohm'sLaw–electromotiveforce–motionalemf–Faraday'sLaw– The inducedelectricfield–Inductance–energy in magnetic fields	5	Lecture , Group Discussion and ICT
	Electrodynamics before Maxwell – How Maxwell Fixed Ampere's law – Maxwell's equation-magnetic charge	5	Lecture , Group Discussion,ICTandSeminar
	Maxwell's equations in matter – boundary conditions. Charge and energy -The Continuity equation – Poynting's theorem.	5	Lecture , Group Discussion and ICT,seminar
UNIT IV	Waves in one dimension: Wave equation – sinusoidal waves – boundary conditions - reflection and transmission – polarization.	5	Lecture , Group Discussion and ICT

	Electromagnetic waves in vacuum: Wave equation for **E** and **B** – monochromatic plane waves – energy and momentum in electromagnetic waves. Electromagnetic waves in matter: Propagation in linear media	5	Lecture , Group Discussion and ICT
	reflection and transmission at normal incidence – reflection and transmission at oblique incidence. Absorption and dispersion: Electromagnetic waves in conductors – reflection at a conducting surface	5	Lecture , Group Discussion and ICT
UNIT V	Guided waves: Wave guides - waves in a rectangular wave guide – coaxial transmission line.	5	Lecture , Group Discussion and ICT
	The potential formulation: Scalar and vector potentials - gauge transformations - Coulomb gauge and Lorenz gauge-Lorentz force law in potential form.	5	Lecture , Group Discussion and ICT,Seminar
	Continuous distributions: Retarded potentials - Jefimenko's equations. - Point charges: Lienard-Wiechertpotentials	5	Lecture , Group Discussion and ICT

Course Outcomes (Cos)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	4	3	4	4	3	4	3	4	3.7
CO2	4	4	3	4	4	4	3	4	4	4	3.8
CO3	4	4	3	4	3	4	4	3	4	4	3.7
CO4	4	3	4	3	4	4	4	3	4	4	3.7
CO5	4	4	4	3	4	4	3	4	4	4	3.8
Mean Overall Score											3.74

Result: The Score for this Course is 3.74 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total Values / Total No. of Pos & PSOs			Mean Overall Score of COs = Total of Mean scores / Total No. of COs		

ASSESSMENT RUBRICS

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 (Remembering/Recalling)	20%	20%
K2 (Understanding/Comprehension)	20%	20%
K3 (Application & Analysis)	30%	30%
K4 (Synthesis & Evaluation)	30%	30%

Course Designer:
1.D.G.KRISHNA BAMA
2. DR.N.NAGARANI

Programme : M.Sc. **DSEC – II**
Semester : II **Hours :5 Hrs P/W 75Hrs P/S**
Sub. Code : P22DSP2A **Credits : 4**

TITLE OF THE PAPER: PROGRAMMING IN C++

Pedagogy	Hours	Lecture	Peer Teaching	GD/ Videos/Tutorial	ICT

	5	2	1	1	1

PREAMBLE: This course helps to provide the fundamental knowledge of a programming language and its features which enhances the user to write general purpose application programs.

COURSE OUTCOME At the end of the Semester, the students will be able to	**Unit**	**Hrs P/S**
CO1: identify the basic concepts needed to develop a program	I	15
CO2: list the features of object oriented programming	II	15
CO3: discuss the concept of object oriented programming**.**	III	15
CO4: use array and structure to handle volume of data	IV	15
CO5: apply advanced programming concepts	V	15

SYLLABUS

UNIT I: INTRODUCTION

Identifiers & keywords - Literals – Operators – Type Conversion – Declaration of variables – Statements – Simple C++ program – Features of iostream.h – Manipulator Functions – Conditional Expressions – Switch Statement – Loop Statements - Breaking Control Statements.

UNIT II: FUNCTIONS, PROGRAM STRUCTURES & ARRAYS

Defining a function – Return statement – Types of functions – Actual and Formal Arguments – Local and Global variables – Default Arguments – Structure of the C++ program – Header files – Array Notation – Array Declaration- Array Initialization – Processing with Array – Arrays & Functions – Multidimensional Arrays – Character Array.

UNIT III : POINTERS, STRUCTURES & UNIONS

Pointer Declaration – Pointer Arithmetic – pointers and Functions – Pointers and Arrays – Pointers and Strings -Array of Pointers – Pointers to pointers – Declaration of Structure – Initialization of Structures – Arrays of Structures – Arrays within a Structure – Structures within a Structure (Nested Structure) Pointers & Structures – Unions

UNIT IV: CLASSES AND OBJECTS

Introduction – Structures and classes – Declaration of class – Member Functions – Defining the object of a class – Accessing a member of class – Array of class objects – Pointers and classes – Unions and classes – Classes within classes (nested class) – Constructors- Destructors

UNIT V : INHERITANCE AND POLYMORPHISM

Introduction – Single Inheritance – Types of Base Classes- Type of Derivation – Ambiguity in Single Inheritances- Multiple Inheritance – Polymorphism – Early Binding – Polymorphism with pointers – Virtual Functions – Constructors under Inheritance.

List of programs

- Program to perform a single arithmetic operation and display the result using c in and c out function.

- Program to show the base of a numeric value of variable using hex and dec manipulation function.
- Program to show the base of a numeric value of a variable using set base manipulator function.
- Program to display the data variable using set W manipulator function.
- Program to use the set precision manipulator function while display the floating point value onto screen.
- Program to display a floating point with all decimal places.
- Program to demonstrate how a fill and width member function is used to display a numerical value in C++.
- Program in C++ to perform the following:
  1. Area of a circle
  2. Area of a rectangle
- Program to find the simple interest for a given principal, rate of interest and number of years.
- Program to find the largest value of any three numbers.
- Program to display the name of the day in a week using if…else/ switch case/ break with switch case structure.
- Program to display the numbers from zero to ten using for loop.
- Program to find the sum and average of the given to numbers using while and for loop.
- Program to the sum of even numbers using do… while loop.
- Program to demonstrate how to declare and invoke a function in the main program using function.
- Program to find the area and circumference of a circle for a given value of radius using function.
- Program to find the sum of the given two numbers using function.
- Program to perform simple arithmetic operations using function.
- Program to find the sum of series using a function.

  Sum = 1 + 2+ 3+ +…………+ n
- Program to illustrate how to declare local variable.
- Program to find the sum of the given numbers using default argument declaration.
- Program to initialize a set of numbers in an array and to display them.
- Program to read 'n' numbers from the keyboard to store it in one dimensional array and to display the content of the array.
- Program to read a set of numbers and to find out the largest number in the given array.
- Program to read a set of numbers and to sort them in ascending order.
- Program to read the elements of the given matrix of order n x n and to display the contents.
- Program to read a set of lines and to store it in a one dimensional array A; copy the contents of A to an array B and display contents of arrays A and B separately.
- Program to assign an address of an integer variable to the pointer variable and display the content of and address of the pointer.
- Program to display the memory address of a variable using pointer before incrementation / decrementation and after incrementation / decrementation.
- Program to display the content of a pointer variable using a pointer arithmetic.
- Program to exchange the contents of two variables using pointers and functions.
- Program to display the contents of pointers using an array of pointers.

- Program to declare the pointer to pointer variable and display the contents of pointer.
- Program to demonstrate how to initialize the members of a structure and display the contents of the structure.
- Program to initialize few members of an array of structures and display the contents of the structure.
- Program to demonstrate how to define, declare and realize a nested structure in C++.
- Program to initialize the members of a union and the contents of the union.
- Program to assign values to the data members of a class such a day, month and year and display the same.
- Program to demonstrate how to define both data member and member function of a class withy in a scope of class definition.
- Program to read the data variable of a class by the member function and display the content of the class object on the screen.
- Program to illustrate the simple arithmetic operation using member function.
- Program to generate Fibonacci series using copy constructor within class.
- Program to data members of base class and display the same.
- Program to get the information of a derived class data members and again to read data for another derived class and display the contents of the newly created class.
- Program to demonstrate how ambiguity is avoided in single inheritance using scope resolution operator.
- Program to illustrate how a multiple inheritance can be declare and defined in a program.
- Program to illustrate how to assign the pointers of the derived class of the object of a base class using explicit casting.
- Program to find the virtual function within the line code substitution for run time binding the member function of a class.
- Program to define and declare a constructor member function under inheritance.

TEXT BOOK:

Programming with C++ - D. Ravichandran, Third edition, Tata McGraw Hill Publishing Company Ltd.,2011.

Unit I **-Ch.3, 4 &5** (Sec.3.1, 3.4, 3.7-3.14, 4.2, 4.4, 4.6, 4.8, 5.1., 5.1.1. - 5.1.3., 5.2, 5.4)
Unit II **-Ch. 6 & 7** (Sec.6.2 – 6.9, 6.18, 7.2 – 7.8)
Unit III **-Ch.8 & 9** (Sec.8.1 - 8.3, 8.6 – 8.9, 9.2, 9.4, 9.6 - 9.10)
Unit IV **-Ch.10 & 11** (Sec.10.1 – 10.10, 11.2, 11.3)
Unit V **-Ch.12 & 14** (Sec.12.1 – 12.5, 12.7, 14.1 -14.4, 14.8)

BOOK FOR REFERENCE:

1. Let us C++ - YashavantKanettkar, 2nd edition, BPB Publications, 2013.
2. Object Oriented Programming with C++ - E. Balagurusamy, 6th edition,

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING

UNIT I	Identifiers & keywords - Literals – Operators – Type Conversion – Declaration of variables – Statements – Simple C++ program	5	Lecture, peer teaching, GD&ICT
	Features of iostream.h – Manipulator Functions – Conditional Expressions – Program	5	Lecture, peer teaching, GD & ICT
	Switch Statement – Loop Statements - Breaking Control Statements- Program	5	Lecture, peer teaching, GD & ICT
UNIT II	Defining a function – Return statement – Types of functions – Actual and Formal Arguments – Local and Global variables – Default Arguments- Program	5	Lecture , peer teaching, GD & ICT
	Structure of the C++ program – Header files – Program	5	Lecture, peer teaching, GD & ICT
	Array Notation – Array Declaration-Array Initialization – Processing with Array – Arrays & Functions – Multidimensional Arrays – Character Array – Program	5	Lecture, peer teaching, GD & ICT
UNIT III	Pointer Declaration – Pointer Arithmetic – pointers and Functions – Pointers and Arrays – Pointers and Strings -Array of Pointers – Pointers to pointers- Program	5	Lecture, peer teaching, GD & ICT
	Declaration of Structure – Initialization of Structures – Arrays of Structures – Arrays within a Structure – Structures within a Structure (Nested Structure) Pointers & Structures – Unions – Program	5	Lecture, peer teaching, GD & ICT
UNIT IV	Introduction – Structures and classes – Declaration of class – Member Functions-Program	5	Lecture, peer teaching, GD & ICT
	Defining the object of a class – Accessing a member of class – Array of class objects	5	Lecture, peer teaching, GD & ICT
	Pointers and classes – Unions and classes – Classes within classes (nested class) – Constructors- Destructors- Program	5	Lecture, peer teaching, GD & ICT
UNIT V	Introduction – Single Inheritance – Types of Base Classes- Type of Derivation – Ambiguity in Single Inheritances-Multiple Inheritance- Program	5	Lecture, peer teaching, GD & ICT
	Polymorphism – Early Binding – Polymorphism with pointers- Program	5	Lecture, peer teaching, GD & ICT
	Virtual Functions – Constructors under Inheritance – Program	5	Lecture, peer teaching, GD & ICT

Course Outcomes (Cos)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	2	3	3	4	3	3	2	4	3.2
CO2	4	3	2	2	4	4	3	3	2	4	3.1
CO3	4	4	3	3	3	4	3	3	3	3	3.3
CO4	4	3	2	3	3	4	3	2	3	3	3.0
CO5	4	4	3	3	4	4	3	3	2	4	3.4
Mean Overall Score											3.16

Result: The Score for this Course is3.16 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = Total of Value / Total No. of POs & PSOs

Mean Overall Score of COs = Total of Mean Score / Total No. of COs

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 – Remembering/Recalling	20%	20%
K2 – Understanding /Comprehension	20%	20%
K3 – Application and Analysis	30%	30%
K4 – Synthesis and Evaluation	30%	30%

Course Designer: Dr.K.Lilly Mary Eucharista, Department of Physics

Programme : M.Sc. **DSEC II**
Semester : I **Hours : 5 P/W 75Hrs P/S**
Sub. Code : P22DSP2B **Credits : 4**
TITLE OF THE PAPER: COMPUTATIONAL PHYSICS

Pedagogy	Hours	Lecture	Peer Teaching	GD/ Vedos/Tutorial	ICT
	5	2	1	1	1

PREAMBLE:

To provide the core tools and methodology of computational physics.The emphasis is on gaining practical skills and a key objective is that the students gain the techniques and the confidence to tackle a broad range of problems in physics. To provide a broad basis of skills and each is illustrated by application to physical system using MATLAB. To provide knowledge about various mathematical methods.This course helps to provide the fundamental knowledge of a programming language and its features which enhances the user to write general purpose application programs.

COURSE OUTCOME At the end of the Semester, the students will be able to	**Unit**	**Hrs P/S**
CO1: understand the basic methodology of computational physics	I	15
CO2: gain the practical skills and a key objective to solve problem in physics object oriented programming	II	15
CO3: apply the physics concepts using MATLAB	III	15
CO4: acquire knowledge about various mathematical methods	IV	15
CO5: enhance the program writing skill	V	15

SYLLABUS

UNIT I: NUMERICAL DIFFERENTIATION

Finding Roots of a Polynomial-Bisection Method-Newton Raphson Method- Solution of Simultaneous Linear Equation by Gauss Elimination Method- Solution of Ordinary Differential Equation by Euler, Runge-Kutta Fourth Order Method for solving first order Ordinary Differential Equations

UNIT II: NUMERICAL INTEGRATION

Newton's cotes formula-Trapezoidal rule-Simpson's 1/3 rule- Simpson's 3/8 ruleBoole's rule-Gaussian quadrature method-(2 point and 3 point formulae)- Giraffe's root square method for solving algebraic equation

UNIT III: MATLAB FUNDAMENTALS

Introduction - Matlab Features-Desktop Windows: Command, Workspace, Command History, Array Editor and Current Directory - Matlab Help and Demos- Matlab Functions, Operators and Commands. Basic Arithmetic in Matlab-Basic Operations with Scalars, Vectors and Arrays-Matrices and Matrix Operations- Complex NumbersMatlab Built-In Functions-Illustrative Examples

UNIT IV: MATLAB PROGRAMMING

Control Flow Statements: if, else, else if, switch Statements - for, while Loop Structures-break Statement- Input/Output Commands-Script "m" Files -Function "m" Files-Controlling Output

UNIT V: MATLAB GRAPHICS

2D Plots-Planar Plots, Log Plots, Scatter Plots, Contour Plots-Multiple Figures, Graph of a Function-Titles, Labels, Text in a Graph- Line Types, Marker types, Colors-3D Graphics-Curve Plots-Mesh and Surface Plots-Illustrative Examples State Integrated Board of Studies – Physics PG 33

BOOKS FOR STUDY:

1. Numerical methods in Science and Engineering- M.K. Venkataraman- National Publishing Co. Madras, 1996.
2. Getting Started With Matlab-RudraPratap-Oxford University Press-New Delhi.

BOOKS FOR REFERENCE:

1. Engineering and Scientific Computations Using Matlab- Sergey E. LyshevskiJohnWiley&Sons.
2. A Guide to Matlab for Beginners & Experienced Users-Brian Hunt, Ronald Lipsman, Jonathan Rosenberg-Cambridge University Press.
3. Matlab Primer-Timothy A. Davis & Kermit Sigmon-Chapman & Hall CRC PressLondon. 4.

Matlab Programming-David Kuncicky-Prentice Hall.
5. An Introduction to Programming and Numerical Methods in MATLAB- S.R. Otto and J.P.Denier-Springer-Verlag-London.
6. Numerical Methods Using Matlab-John Mathews &Kurtis Fink-Prentice Hall-New Jersey,2006.
7. Introductory Methods of Numerical Analysis- S.S. Sastry-Prentice Hall, 2005

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I	Finding Roots of a Polynomial-Bisection Method-Newton Raphson Method-	5	Lecture , peer teaching, GD & ICT
	Solution of Simultaneous Linear Equation by Gauss Elimination Method-	5	Lecture , peer teaching, GD & ICT
	Solution of Ordinary Differential Equation by Euler, Runge-Kutta Fourth Order Method for solving first order Ordinary Differential Equations	5	Lecture , peer teaching, GD & ICT
UNIT II	Newton’s cotes formula-Trapezoidal rule	5	Lecture , peer teaching, GD & ICT
	Simpson’s 1/3 rule- Simpson’s 3/8 ruleBoole’s rule-Gaussian quadrature method-(2 point and 3 point formulae)-	5	Lecture , peer teaching, GD & ICT
	Giraffe’s root square method for solving algebraic equation	5	Lecture , peer teaching, GD & ICT
UNIT III	Introduction - Matlab Features-Desktop Windows: Command, Workspace, Command History	5	Lecture , peer teaching, GD & ICT
	Array Editor and Current Directory - Matlab Help and Demos- Matlab Functions, Operators and Commands. Basic Arithmetic in Matlab	5	Lecture , peer teaching, GD & ICT
	Basic Operations with Scalars, Vectors and Arrays-Matrices and Matrix Operations- Complex Numbers - Matlab Built-In Functions-Illustrative Examples		
UNIT IV	Control Flow Statements: if, else, else if, switch Statements -	5	Lecture , peer teaching, GD & ICT
	for, while Loop Structures-break Statement- Input/Output Commands	5	Lecture , peer teaching, GD & ICT
	Script “m‟ Files -Function “m‟ Files-Controlling Output	5	Lecture , peer teaching, GD & ICT
UNIT V	2D Plots-Planar Plots, Log Plots, Scatter Plots, Contour Plots-Multiple Figures,	5	Lecture , peer teaching, GD & ICT
	Graph of a Function-Titles, Labels, Text in a Graph- Line Types, Marker types,	5	Lecture , peer teaching, GD & ICT

	Colors-3D		
	Graphics-Curve Plots-Mesh and Surface Plots-Illustrative Examples State Integrated Board of Studies – Physics PG 33	5	Lecture , peer teaching, GD & ICT

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	2	3	3	4	3	3	2	4	3.2
CO2	4	3	2	2	4	4	3	3	2	4	3.1
CO3	4	4	3	3	3	4	3	3	3	3	3.3
CO4	4	3	2	3	3	4	3	2	3	3	3.0
CO5	4	4	3	3	4	4	3	3	2	4	3.4
Mean Overall Score											3.16

Result: The Score for this Course is 3.16 (High Relationship)

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

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 – Remembering/Recalling	20%	20%
K2 – Understanding /Comprehension	20%	20%
K3 – Application and Analysis	30%	30%
K4 – Synthesis and Evaluation	30%	30%

Course Designer: Dr. K.Lilly Mary Eucharista Department of Physics

Programme : M..Sc **SEC - II**
Semester : II **Hours : 2 P/W , 30 Hrs P/S**
Sub. Code : P22SEP2 **Credits : 2**

TITLE OF THE PAPER: NANOSCIENCE AND NANO TECHNOLOGY

Pedagogy	Hours	Lecture	Peer Teaching	GD/ Videos/Tutorial	ICT
	2	1			1

PREAMBLE: To understand the history of nano science, different types, synthesis and characterization of nano particles and their applications.'

COURSE OUTCOME At the end of the Semester, the students will be able to	**Unit**	**Hrs P/S**
CO 1 : know the history of nano science and Nanotechnology	I	6
CO 2: understand the different types of nano particles	II	6
CO 3: Gain knowledge in various methods used for synthesis ofnano particles	III	6
CO 4: Explain the various characterization techniques used for analysis of nano materials	IV	6
CO 5: Understand the application of nano materials in various fields	V	6

SYLLABUS

NANOSCIENCE AND NANO TECHNOLOGY

UNIT I – INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY

Introduction- History of Nano technology- Classification of Nanomaterials-Properties of Nano materials- Effect of surface area to volume ratio on the properties of materials.

UNIT II – TYPES OF NANOSTRUCTURES

Quantum Dots - Quantum wires- Quantum well-Fullerenes-Carbon nano tubes.

UNIT III –SYNTHESIS OF NANOMATERIALS

Top Down and Bottom Up approaches- Top Down Techniques- Ball Milling –Etching- Nanolithography- Bottom Up Techniques – Hydrothermal - Sol-Gel – Co precipitation process.

UNIT IV - CHARACTERIZATION TECHNIQUES

Powder X - Ray Diffraction, Scanning electron microscope (SEM), Transmission electron microscope (TEM), UV-Visible absorption - Energy dispersive X– **ray analysis (EDAX)**

UNIT V - APPLICATIONS OF NANO MATERIALS

Nano electronics- Nano robotics-Photo electro chemical cells- Solar cells -Nano drug delivery- Medical Applications

TEXT BOOKS:

1. Viswanathan, B., 2013, "Nanomaterials", Fourth Edition, Narosa Publishing House Pvt. Ltd., New Delhi.
2. Ramachandra Rao, M. S. and Singh, S., 2013, "Nanoscience and Nanotechnology : Fundamentals to Frontiers", First Edition, Wiley India Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1.Introduction to Nanotechnology - Charles P.Poole, Frank J. Owens, Wiley – India, 2009.
2.Nanostructures and Nanomaterials synthesis, properties and applications - Guozhong Gao, Imperial College Press, London, 2004.
3.Metal Oxides - V. Henrich, P.A.Cox, Cambridge University Press, New York, 1994.

4. NATO ASI Series, Science and Technology of Nanostructured Magnetic Materials - Ed. George C. Hadjipanyis and Gary A.Prinz, , Plenum Press, New York, 1991.
5. Introduction to Magnetism and Magnetic Materials - D.Jiles, Chapman and Hall, London, 1991.
6.Physics and Chemistry of Metal Cluster Compounds - J.de Jongh, Kluwer Academic Publishers, Dordrecht, 1994.

Web Resources

1. https://www.nanowerk.com/nanotechnology/introduction/introduction_to_nanotechnology_1.php
2. https://www.azonano.com/article.aspx?ArticleID=4938
3. https://pubs.rsc.org/en/content/articlehtml/2021/ma/d0ma00807a
4. https://innovareacademics.in/journals/index.php/ijcpr/article/view/41556/24630
5. https://www.ijesm.co.in/uploads/68/4481_pdf.pdf
6. https://www.researchgate.net/publication/331470948_Different_Applications_of_Nanomaterialsand_Their_Impact_on_the_Environment
7. https://www.uc.edu/content/dam/refresh/cont-ed-62/olli/olli_docs/nano-meta-materials.pdf

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I	Introduction- History of nanotechnology – Classifications of nanomaterials – Properties of nanomaterials – Effect of surface area to volume rat on the properties of materials.	6	Lecture, ICT and Group discussion
UNIT II	Quantum Dots- Quantum wires - Quantum well – Fullerenes – Carbon nanotubes.	6	Lecture and Group discussion, ICT
UNIT III	Top Down and Bottom Up approaches- Top Down Techniques- Ball Milling –Etching- Nanolithography- Bottom Up Techniques – Hydrothermal - Sol-Gel – Co precipitation process	6	Lecture, ICT and Group discussion
UNIT IV	Powder X - Ray Diffraction-Scanning electron microscope (SEM)- Transmission electron microscope (TEM)- UV-Visible absorption - Energy dispersive X– ray analysis (EDAX)	6	Lecture, ICT and Group discussion
UNIT V	Nano electronics- Nano robotics-Photo electro chen cells- Solar cells -Nano drug delivery- Medical Applications	6	Lecture, ICT and Group discussion

Course Outcomes (Cos)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	4	4	4	4	3	3	3	4	3.6
CO2	4	3	4	3	4	3	3	4	3	4	3.5
CO3	4	4	3	4	3	4	4	3	4	4	3.7
CO4	4	3	4	3	4	3	4	3	4	4	3.6
CO5	4	4	3	4	4	4	3	4	3	4	3.7
Mean Overall Score											3.62

Result: The Score for this Course is 3.62 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Total of Value Mean Score of COs = ------------------------ Total No. of Pos& PSOs			Total of Mean Score Mean Overall Score of COs =------------------------ Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 (Remembering/Recalling)	20%	20%
K2 (Understanding/Comprehension)	20%	20%
K3 (Application & Analysis)	30%	30%
K4 (Synthesis & Evaluation)	30%	30%

Course Designer: 1. DR.N.NAGARANI

Programme : M. Sc.,
Semester : I I
Sub. Code : P22CP8P

Part III: Core paper
Hours : 6 P/W 90 Hrs P/S
Credits : 3

TITLE OF THE PAPER: PHYSICS PRACTICAL - II

Pedagogy	**Hours**	**Lab Experimentation**	**Peer Teaching**	**GD/VIDOES/TUTORIAL**	**ICT**
	3+3	3+3	-	-	-

PREAMBLE: The purpose of the *course* is to make the students to construct electronic circuits using Diodes, transistors and ICs and study their behavior. To make the students to know the applications of ICs as Astable, Bistble, Schimtt Trigger and Phase-Shift Oscillator …by construction .
COURSE OUTCOME At the end of the Semester, the Students will be able to **CO1**: Construct electronic circuits using logic gates & ICs **CO2**: Perform arithmetic operations using ICs **CO3**: Construct different types of waveforms **CO4**: Understand the theoretical concepts by doing experiments **CO5**: Understand applications of ICs by doing experiments

S.NO	**EXPERIMENT (ANY TEN)**
1.	CONSTRUCT THE DUAL POWER SUPPLY AND MEASURE ITS OUTPUT.
2.	STUDY OF VARIOUS LOGIC FAMILIES (DRL, DTL AND TTL).
3.	DESIGN STUDY OF TWO –STAGE RC-COUPLED TRANSISTOR AMPLIFIER.(With and without FEED BACK).
4.	DESIGN AND STUDY OF VARIOUS FLIP-FLOPS (RS, D, JK, AND T).
5.	VERIFICATION OF ASSOCIATIVE AND DISTRIBUTIVE LAWS BY IC'S.
6.	STUDY THE BOOLEAN LOGIC OPERATION USING IC'S.
7.	DESIGN AND STUDY THE ADDER AND SUBTRACTOR USING IC 741.
8.	DESIGN AND STUDY OP-AMP IC741 AS A ASTABLE MULTIVIBRATOR.
9.	DESIGN AND STUDY OP-AMP IC741 AS A BISTABLE MULTIVIBRATOR.
9.	DESIGN AND STUDY OP-AMP IC741 AS A SCHMITT TRIGGER.
10.	DESIGN AND STUDY OP-AMP IC741 AS A PHASE SHIFT OSCILLATOR.
11.	DESIGN AND STUDY THE DIFFERENTIATOR AND INTEGRATOR USING IC 741.

Course Designer : **Dr. Mrs. SANTHI.** Department of PHYSICS

Programme : M.Sc. **CC : IX**
Semester : III **Hours : 6 Hrs P/W 90Hrs P/S**
Sub. Code : P22CP9 **Credits : 5**

TITLE OF THE PAPER: CONDENSED MATTER PHYSICS –I

Pedagogy	Hours	Lecture	Peer Teaching	GD/Videos/Tutorial	ICT

	6	3	1	1	1

PREAMBLE: Give strong foundation in the conceptual understanding of the development of solid state physics with appropriate theoretical background.

COURSE OUTCOME At the end of the semester, the students will be able to	Unit	Hrs P/S
CO1 : explain about the crystal structure and crystal binding	I	18
CO2 : predict about diffraction of waves and particles by Crystals	II	18
CO3 : demonstrate about crystal imperfections	III	18
CO4 : explain about phonon, heat capacity of phonon and anharmonic effects	IV	18
CO5 : interpret the theory of electrons	V	18

SYLLABUS

UNIT I : CRYSTAL PHYSICS

Crystal structure: Lattice representation - Simple symmetry operations - Unit cell, Wigner - Seitz cell, Bravais Lattices - Miller indices - Structural features of NaCl, CsCl, Diamond, ZnS – Hexagonal Close-packed structure.

Crystal binding: Interactions in inert gas crystals and cohesive energy – Lennard – Jonespotential - Interactions in ionic crystals and Madelung energy - Covalent bonding – Metallic bonding - Hydrogen bonding.

UNIT II : DIFFRACTION OF WAVES AND PARTICLES BY CRYSTALS

X-ray diffraction – The Laue equations – Equivalence of Bragg and Laue equations – Interpretation of Bragg equation – Ewald construction – Reciprocal lattice –Reciprocal lattice to SC, BCC and FCC crystals – X-ray Diffraction experiment - The Powder method – Powder Diffractometer - The Laue method – The Rotating / Oscillation method – Other Diffraction Methods.

UNIT III : CRYSTAL IMPERFECTIONS

Point imperfections – Concentrations of Vacancy, Frenkel and Schottky imperfections – Line Imperfections – Burgers Vector – Presence of dislocation – Dislocation motion – Perfect and imperfect dislocations - surface imperfections – Grain boundary – Tilt and Twist boundary – Stacking Faults – Stacking Faults in hcp Crystals.

UNIT IV : LATTICE DYNAMICS

Quantization of elastic waves - Phonons – Phonon momentum – In elastic scattering by phonon.

Heat Capacity : Phonon heat capacity – Planck Distribution – Density of states in One and Three dimensions - Debye Model and Einstein model of heat capacity.

Anharmonic Effects: Explanation for Thermal expansion – Thermal Conductivity and Resistivity – Umklapp process.

UNIT V : THEORY OF ELECTRONS

Energy levels in one dimension – Effect of temperature on the Fermi Dirac distribution – Free electron gas in three dimensions – Heat Capacity of the Electron gas – Electrical Conductivity and Ohm's law – Hall effect – Wiedemann-Franz law.

Nearly free electron model and the origin and magnitude of energy gap – Bloch functions - Kronig – Penney model - Approximate solution near a zone boundary –Metals and insulators – effective mass - Construction of Fermi surfaces: Reduced and periodic zone schemes of construction- De Haas – van Alphen effect.

TEXT BOOKS :

1. Introduction to Solid State Physics, Charles Kittel, VII Edition Wiley India Pvt. Ltd., 2011.
   Unit I -Ch. 1,2 & 3 (pg. 4,6,8,11,13-17,49,58,60,67,69,70)
   Unit IV-Ch. 4 & 5 (pg. 99,100,107,108,111,112,114,120,121,123,125)
   Unit V - Ch. 6,7 & 9 (pg. 134,136,137,141,147,153,156,164,166-168,177,181,197,223-225,244)

2. Solid State Physics – Structure and Properties of Materials, M. A. Wahab,. Narosa,New Delhi, 1999.
   Unit II -Ch. 8 (Sec. 8.6-8.12, 8.15-8.20)
   Unit III-Ch. 5 (Sec. 5.1-5.7,5.10,5.12)

BOOK FOR REFERENCE:

1. Electrical Engineering Materials, A. J. Dekker, Prentice Hall of India, 1975.
2. Problems and Solutions in Solid State Physics, S.O. Pillai, New Age international Publishers, New Delhi, 1994.
3. M. Ali Omar, Elementary Solid State Physics – Principles and Applications, Pearson, 1999.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
	Lattice representation - Simple symmetry operations - Unit cell, Wigner -Seitz cell, Bravais Lattices - Miller indices	6	Lecture, Peer Teaching Tutorial & ICT
UNIT I	Structural features of NaCl, CsCl, Diamond, ZnS – Hexagonal Close-packed structure	5	Lecture, Peer Teaching Tutorial

			& ICT
	Interactions in inert gas crystals and cohesive energy – Lennard – Jones potential - Interactions in ionic crystals and Madelung energy - Covalent bonding – Metallic bonding - Hydrogen bonding.	7	Lecture, Peer Teaching Tutorial & ICT
UNIT II	X-ray diffraction – The Laue equations – Equivalence of Bragg and Laue equations – Interpretation of Bragg equation	6	Lecture, Peer Teaching Tutorial & ICT
	Ewald construction – Reciprocal lattice –Reciprocal lattice to SC, BCC and FCC crystals	5	Lecture, Peer Teaching Tutorial & ICT
	X-ray Diffraction experiment - The Powder method – Powder Diffractometer - The Laue method - The Rotating / Oscillation method – Other Diffraction Methods.	7	Lecture, Peer Teaching Tutorial & ICT
UNIT III	Point imperfections – Concentrations of Vacancy, Frenkel and Schottky imperfections	6	Lecture, Peer Teaching Tutorial & ICT
	Line Imperfections – Burgers Vector – Presence of dislocation – Dislocation motion – Perfect and imperfect dislocations	6	Lecture, Peer Teaching Tutorial & ICT
	surface imperfections – Grain boundary – Tilt and Twist boundary – Stacking Faults – Stacking Faults in hcp Crystals	6	Lecture, Peer Teaching Tutorial & ICT
UNIT IV	Quantization of elastic waves - Phonons – Phonon momentum – In elastic scattering by phonon	6	Lecture, Peer Teaching Tutorial & ICT
	Phonon heat capacity – Planck Distribution – Density of states in One and Three dimensions - Debye Model and Einstein model of heat capacity	6	Lecture, Peer Teaching Tutorial & ICT
	Explanation for Thermal expansion – Thermal Conductivity and Resistivity – Umklapp process	6	Lecture, Peer Teaching Tutorial & ICT
UNIT V	Energy levels in one dimension – Effect of temperature on the Fermi Dirac distribution – Free electron gas in three dimensions – Heat Capacity of the Electron gas	6	Lecture, Peer Teaching Tutorial & ICT
	Electrical Conductivity and Ohm's law – Hall effect – Wiedemann-Franz law - Nearly free electron model and the origin and magnitude of energy gap – Bloch functions - Kronig – Penney model	6	Lecture, Peer Teaching Tutorial & ICT
	Approximate solution near a zone boundary –Metals and insulators – effective mass - Construction of Fermi surfaces: Reduced and periodic zone schemes of construction- De Haas – van Alphen effect	6	Lecture, Peer Teaching Tutorial & ICT

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	

CO1	3	4	3	4	3	3	3	3	3	5	3.4
CO2	5	3	4	3	5	3	3	4	3	4	3.7
CO3	3	3	3	3	3	3	5	4	3	4	3.4
CO4	3	3	4	3	3	3	5	4	3	4	3.5
CO5	4	3	3	4	4	3	3	4	4	3	3.5
Mean Overall score											3.5

Result: The Score for this Course is **3.5** (High Relationship)

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

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 - Remembering/Recalling	20%	20%
K2 - Understanding/Comprehension	20%	20%
K3 - Application & Analysis	30%	30%
K4 - Synthesis & Evaluation	30%	30%

Course Designer**:** Dr.M. Mahalakshmi, Department of Physics

Programme : M.Sc PHYSICS **PART III : Core - X**
Semester : III **Hours : 6 P/W, 90 Hrs P/S**
Sub code : P22CP10 **Credits : 5**

TITLE OF THE PAPER : QUANTUM MECHANICS – II

Pedagogy	Hours	Lecture	Peer teaching	TUTORI AL	ICT
	6	**3**	**1**	**1**	**1**

PREAMBLE :

The aim of this course is to give reasonable details about the approximation methods for time independent and time dependent perturbationtheory , WKB approximation , quantum theory of atomic and molecular structure, relativistic quantum mechanics and quantization of the field.

COURSE OUTCOME At the end of the Semester, the students will be able to	**UNIT**	**Hrs P/S**
CO1 :Acquire knowledge about perturbation theory for discrete levels, differentiate degenerate and non- degenerate, understand stark effect in hydrogen atom.	1	18
CO2 : Know transition probability of first order transition , interpret constant perturbation, harmonic perturbation, understand interaction of atoms with electromagnetic field , dipole approximations	2	18
CO3: Know variation method , determine asymptotic solution of Schrodinger equation , analyse solution near a turning point , understand Bohr-Sommerfeld quantum condition.	3	18
CO4 : Get knowledge about central field approximation , interpret residual electrostatic interaction and spin orbit interaction , determine central field by Thomas Fermi method and Hartree method , understand Born Oppenheimer approximation and LCAO approximation .	4	18
CO5: Derive Klein – Gordon equation, Dirac equation , determine charge and current density from Klein – Gordon equation , position probability density from Dirac equation , find plane wave solutions of Dirac equation , determine spin of Dirac particle , understand significance of negative energy states.	5	18

SYLLABUS

UNIT-I : APPROXIMATION METHODS FOR TIME INDEPENDENT PROBLEMS
Perturbation theory for discrete levels – equations in various orders of perturbation theory Non-degenerate case :first and second order – Degenerate case- Stark effect in ground state of hydrogen atom.

UNIT-II : APPROXIMATION METHODS FOR TIME DEPENDENT PERTURBATION THEORY
First order transitions : transition probability – Constant perturbation : Fermi Golden Rule (constant transition rate) – Harmonic perturbation : amplitude for transition with change of energy - Interaction of an atom with electromagnetic radiation - Dipole approximation- Selection rules – Forbidden transitions - Einstein's coefficients : spontaneous emission

UNIT-III : VARIATION METHOD
Variation method : upper bound on ground state energy – Application to excited states - WKB approximation :one dimensional Schrodinger equation : Asymptotic solution - solution near a turning point – Asymptotic connection formula – Bohr-Sommerfeld quantum condition.

UNIT–IV : QUANTUM THEORY OF ATOMIC AND MOLECULAR STRUCTURE
Central field approximation -Residual electrostatic interaction-spin-orbit interaction - Determination of central field: Thomas Fermi statistical method-Hartree self - consistent method - Born-Oppenheimer approximation – Molecular orbital method (LCAO approximation) – MO treatment of Hydrogen molecule.

UNIT-V : RELATIVISTIC QUANTUM MECHANICS
Generalization of Schrodinger equation - Charge and current densities – Dirac's relativistic Hamiltonian – Position probability density - Plane wave solutions of the Dirac equation – Spin of Dirac particle – Significance of negative energy states – Dirac particle in electromagnetic field

BOOKS FOR STUDY:

1. A Text book of Quantum Mechanics - P. M. Mathews and K. Venkatesan, Tata McGraw – Hill Publications, Second Edition, 2010.
   Unit – I : page no. (178-182, 183,184, 186-188)
   Unit – II : page no. (339-341 , 351-352, 354-359)
   Unit – III : page no. (192-193 , 200-203, 205-208)
   Unit – IV : page no. (448-452)
   Unit – V : page no. : (388-390, 394 – 396 398 – 402 , 404-406)

2. A Text book of Quantum Mechanics – G. Aruldhas, second edition, Prentice Hall of India Pvt. Ltd., 2016
   Unit – IV : page no. (442-444, 448-451)

BOOKS FOR REFERENCE

1. Quantum Mechanics V. K. Thankappan, New Age International (P) Ltd. Publication, Second Edition, 2003.
2. Quantum mechanics - Franz Schwabl, Narosa Publications, Fourth Edition, 2007.
3. Molecular Quantum mechanics - P.W.Atkins and R.S. Friedman,), Oxford University Press publication, Fifth Edition, 2010.
4. Quantum Mechanics – Theory and Applications, A. K. Ghatak and Lokanathan, Macmillan India Ltd Publication, Fifth Edition, 2015.
5. Quantum Mechanics - Leonard I. Schiff

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT – I	Perturbation theory for discrete levels	3	(L) , (I) , (P)
	Equations in various orders of perturbation theory	3	(L) , (I) , (P)
	Non-degenerate case – first order	3	(2L) , (T)
	Second order	3	(L) , (P) ,(I)
	Degenerate case	3	(2L) , (T)
	Stark effeck in ground state of hydrogen atom	3	(L) , (I),(T)
UNIT –II	First order transition – transition probability	3	(L) , (I), (P)
	Constant perturbation : constant transition rate (Fermi-Golden rule)	3	(L),(I) , (T)
	Harmonic perturbation – amplitude for transition with change of energy	3	(L),(P) , (I)
	Interaction of an atom with electromagnetic radiation	3	(2L),(T)
	Dipole approximation , selection rules , forbidden transition	3	(2L),(P)
	Einstein's coefficients : spontaneous emission	3	(2L),(T)
UNIT-III	Variation method : upper bound on ground state energy	3	(L),(I) , (P)
	Application to excited states	3	(L),(I)(P)
	WKB approximation : one dimension Schrodinger equation	3	(2L),(T)
	Asymptotic solution , solution near a turning point	3	(2L),(I)
	Asymptotic connection formula	3	(L),(T),(P)
	Bohr-Sommerfeld quantum condition	3	(2L),(T)

UNIT-IV	Central field approximation	3	(L),(P) , (I)
	Residual electrostatic interaction , spin orbit interaction	3	(2L),(T)
	Determination of central field – Thomas Fermi statistical method	3	(L),(P),(I)
	Hartree self- consistent method	3	(2L)(T)
	Born-Oppenheimer approximation	3	(L),(T) ,(I)
	Molecular orbital method , MO treatment of hydrogen molecule	3	(2L),(P)
UNIT-V	Generalization of Schrodinger equation : Klein – Gordon equation , charge and current densities	3	(2L),(I)
	Dirac's relativistic Hamiltonian	3	(L),(I) , (P)
	Position probability density	3	(L),(T),(I)
	Plane wave solutions of Dirac's equation	3	(2L),(T)
	Spin of the Dirac particle	3	(L),(T),(P)
	Significance of negative energy states , Dirac particle in electromagnetic field	3	(2L) ,(P)

Course outcomes	**Programme outcomes**					**Programme specific outcomes**					**Mean scores**
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	
CO1	5	5	3	3	3	5	5	4	4	3	4.0
CO2	5	5	3	3	3	5	5	4	3	3	3.9
CO3	5	5	4	4	4	5	5	4	3	3	4.2
CO4	5	5	4	4	4	4	4	4	3	3	4.0
CO5	5	5	4	3	4	5	5	4	4	3	4.2
Mean overall score											4.06

Result : The Score for this course is 4.06 - High

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 (Remembering/Recalling)	20%	20%
K2 (Understanding/Comprehension)	20%	20%
K3 (Application & Analysis)	30%	30%
K4 (Synthesis & Evaluation)	30%	30%

Course Designer : Dr. J.S.P.CHITRA , Department of PHYSICS

Programme : M.Sc. **CC : XI**
Semester : III **Hours : 5 Hrs P/ W 75 Hrs P/S**
Sub. Code : P22CP11 **Credits : 5**

TITLE OF THE PAPER : MOLECULAR SPECTROSCOPY

Pedagogy	Hours	Lecture	Peer Teaching	GD/Videos/Tutorial	ICT
	5	2	1	1	1

PREAMBLE: To acquire in-depth knowledge and understanding of Molecular Spectroscopy and its applications.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: understand the theory of rotational spectra of a rigid diatomic molecule and Stark effect.	I	15
CO2: classify the vibrating diatomic molecule on the basis of its type of vibration and IR spectrometer.	II	15
CO3: discuss Raman Scattering with the effect of rotation and vibration of molecules.	III	15
CO4: understand NMR and ESR with its applications.	IV	15
CO5: explain Mossbauer effect and magnetic hyperfine interaction.	V	15

SYLLABUS

UNIT I: MICROWAVESPECTROSCOPY

Classification of Molecules (linear, symmetric tops, spherical tops, asymmetric tops) – Interaction of Rotation with Rotating molecule - Rotational Spectra of Rigid Diatomic Molecules – Isotopic Effect of Rotational Spectra - Intensity of Spectral Lines –Linear Polyatomic Molecules - Stark Effect – Microwave Spectrometer - Information derived from Rotational Spectra Substitution (Molecular Structure, Dipole Moment, Atomic mass, Nuclear Quadrupole Moment).

UNIT II: INFRARED SPECTROSCOPY

Vibrational energy of a diatomic molecule - Vibrating diatomic molecule –Diatomic vibrating rotator-Vibrations of poly atomic molecules – Normal Vibration of CO_2 and H_2O molecules - Normal modes of vibration in crystal - Interpretation of vibrational spectra-Group frequencies – IR spectrophotometer - Instrumentation – Sample handling techniques –Fourier Transform Infrared spectroscopy – Applications.

UNIT III: RAMAN SPECTROSCOPY

Introduction-Theory of Raman scattering (classical theory and quantum theory) -Rotational Raman spectra-Vibrational Raman spectra-MutualExclusionprinciple-Ramanspectrometer-Samplehandlingtechniques-Ramaninvestigation of phase transitions-Hyper Raman effect-Stimulated Raman scattering-Inverse Raman effect-Coherent -Anti-Stokes Raman scattering.

UNIT IV: NUCLEAR MAGNETIC &ELECTRON SPINRESONANCE

Magnetic properties of Nuclei – resonance condition – NMR Instrumentation– relaxation processes– Bloch Equation –chemical shifts, ESR- Introduction - Basic principle - ESR spectrometer – Total Hamiltonian – Hyperfine structure – ESR spectrum of hydrogen atom –one electron coupled to a nucleus of spin 1 – unpaired electron with two equivalent nuclei of spin ½ - unpaired electron with two non equivalent nuclei of spin ½.

UNIT V: NUCLEAR QUADRUPOLE RESONANCE AND MOSSBAUERSPECTROSCOPY

The quadrupole nucleus – principle –Transition frequency–Half and Integral spin–Instrumentation.Mossbauereffect-recoillessemissionandabsorption-Mossbauerspectrometer – isomer shift –quadruple interactions – magnetic hyperfine interaction applications.

TEXT BOOK:

1. Molecular Structure and Spectroscopy, G Aruldhas , II Edn., Prentice Hall of India , 2007.

Unit I - Ch. 6 (Sec. 6.1 -6.5, 6.8, 6.11, 6.14, 6.15).

Unit II - Ch. 7 (Sec. 7.1 , 7.4, 7.5, 7.7,7.7.1, 7.12,7.14, 7.16 – 7.19.5).

Unit III - Ch. 8 (Sec. 8.2- 8.7, 8.13,15.5-15.8).

Unit IV - Ch. 10 (Sec 10.1-10.3, 10.5,10.6,10.8),Ch 11- (Sec 11.1-11.5.5).

Unit V - Ch. 12 (Sec 12.1-12.3.3,12.5.1,12.5.2), Ch 13- (Sec 13.1-13.6).

BOOK FOR REFERENCE:

1. Introduction to Molecular Spectroscopy, G.M.Barrow International Student Edn. MC Graw Hill International Company, 1984.
2. Introduction to Molecular Spectroscopy, C.N. Banwell, III Edn
3. Spectroscopy, Gurdeep R Chatwaal & Shyam K Anand, V Edn., Himalaya Publishing house, 2002.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I	Classification of Molecules (linear, symmetric tops, spherical tops, asymmetric tops), Interaction of Rotation with Rotating molecule, Rotational Spectra of Rigid Diatomic Molecules	5	Lecture, Peer teaching, GD, ICT
	Isotopic Effect of Rotational Spectra , Intensity of Spectral Lines , Linear Polyatomic Molecules, Stark Effect	5	Lecture, Peer teaching, GD, ICT
	Microwave Spectrometer Information derived from Rotational Spectra Substitution (Molecular Structure, Dipole Moment, Atomic mass, Nuclear Quadrupole Moment).	5	Lecture, Peer teaching, GD, ICT
UNIT II	Vibrational energy of a diatomic molecule , Vibrating diatomic molecule –Diatomic vibrating rotator,Vibrations of poly atomic molecules	5	Lecture, Peer teaching, GD, ICT
	Normal Vibration of CO_2 and H_2O molecules, Normal modes of vibration in crystal, Interpretation of vibrational spectra, Group frequencies	5	Lecture, Peer teaching, GD, ICT
	IR spectrophotometer , Instrumentation, Sample handling techniques, Fourier Transform Infrared	5	Lecture, Peer teaching, GD, ICT

	spectroscopy – Applications.		
UNIT III	Introduction, Theory of Raman scattering (classical theory and quantum theory), Rotational Raman spectra.	5	Lecture, Peer teaching, GD, ICT
	Vibrational Raman spectra, Mutual Exclusion principle, Raman spectrometer, Sample handling techniques, Raman investigation of phase transitions.	5	Lecture, Peer teaching, GD, ICT
	Hyper Raman effect, Stimulated Raman scattering, Inverse Raman effect, Coherent Anti-Stokes Raman scattering.	5	Lecture, Peer teaching, GD, ICT
UNIT IV	Magnetic properties of Nuclei, resonance condition, NMR Instrumentation, relaxation processes, Bloch Equation.	5	Lecture, Peer teaching, GD, ICT
	Chemicalshifts, ESR- Introduction, Basic principle , ESR spectrometer, Total Hamiltonian, Hyperfine structure, ESR spectrum of hydrogen atom.	5	Lecture, Peer teaching, GD, ICT
	One electron coupled to a nucleus of spin 1, unpaired electron with two equivalent nuclei of spin ½ , unpaired electron with two non equivalent nuclei of spin ½.	5	Lecture, Peer teaching, GD, ICT
UNIT V	The quadrupole nucleus, principle, Transitionfrequency, Half and Integral spin.	5	Lecture, Peer teaching, GD, ICT
	Instrumentation, Mossbauer effect, recoilless emission and absorption.	5	Lecture, Peer teaching, GD, ICT
	Mossbauer spectrometer, isomer shift, quadruple interactions, magnetic hyperfine interaction applications.	5	Lecture, Peer teaching, GD, ICT

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)						Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	3	4	4	3	3	4	4	4	4	3	3	3.54
CO2	3	4	4	3	3	4	4	4	4	3	3	3.54
CO3	3	4	4	3	3	4	4	4	4	3	3	3.54
CO4	3	4	4	3	3	4	4	4	4	3	3	3.54
CO5	3	4	4	3	3	4	4	4	4	3	3	3.54
Mean Overall Score												3.54

Result: The Score for this Course is **3.54** (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = $\frac{\text{Total of Value}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score of Cos = $\frac{\text{Total of Mean Score}}{\text{Total No. of Cos}}$

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 - Remembering/Recalling	20%	20%
K2 - Understanding/Comprehension	20%	20%
K3 - Application & Analysis	30%	30%
K4 - Synthesis & Evaluation	30%	30%

Course Designer: Dr. R.Vijayalakshmi, Department of Physics

Programme : M.Sc.
Semester : III
Sub. Code : P22DSP3A

ELECTIVE PAPER : III
Hours : 5 P/W , 75 Hrs P/S
Credits : 4

TITLE OF THE PAPER :CRYSTAL GROWTH AND THIN FILMS

Pedagogy	Hours	Lecture	Peer Teaching	GD/ Videos/Tutorial	ICT
	5	2	1	1	1

PREAMBLE: To understand the theories of nucleation, various methods of crystallization, various methods of preparation of thin films and characterization techniques used for materials.

COURSE OUTCOME At the end of the Semester, the students will be able to	Unit	Hrs P/S
CO 1 : know the theories of nucleation and derive equations for various types of nucleus	I	15
CO 2: understand various methods of crystallization	II	15
CO 3:explain the principle and working of vapour, melt and gel growth techniques	III	15
CO 4:gain knowledge in various methods used for synthesis of thin films	IV	15
CO 5: Understand the various characterization techniques used for materials	V	15

SYLLABUS
CRYSTAL GROWTH AND THIN FILMS

UNIT I : NUCLEATION

Nucleation -Theories of nucleation – Classical theory of nucleation– Gibbs Thomson equation for vapour-Modified Thomson's equation for melt- Gibbs Thomson equation for solution– Energy of formation of a nucleus–Spherical nucleus – Cylindrical nucleus–Heterogeneous Nucleation – Cap-shaped nucleus–Disc-shaped nucleus.

UNIT II : SOLUTION GROWTH

Low temperature solution growth –Solution, solubility and super solubility–Expression of supersaturation– Methods of crystallization – Crystallization by slow cooling of solution– Crystallization by solvent evaporation–Temperature gradient method–Crystal growth system – Constant temperature bath – crystallizer- High temperature solution growth-principles of flux growth

UNIT III : MELT, VAPOUR AND GEL GROWTH TECHNIQUES

Growth from the melt: Bridgeman Technique- container selection- Czochralski Technique-Vapour Growth–Physical Vapour Deposition–Chemical Vapour Deposition–Advantages of CVD–Disadvantages of CVD–Gel Growth–Principle–Various Types of Gel- Structure of gel–Growth of Crystals in gels–importance of gel Technique- Experimental Procedure –Single and Double diffusion method–Chemical reduction method–Complex -decomplexion method–Solubility reduction method.

UNIT IV: THIN FILMS

Introduction –Nature of Thin films —Electron beam method – Cathodic sputtering -Reactive sputtering- Radio Frequency Sputtering–Chemical vapour deposition –Pyrolysis- - vapour phase reaction-Chemical Deposition- electro deposition –anodic oxidation- Electroless plating.

UNIT V CHARACTERIZATION TECHNIQUE

Crystallinity, Structural phase, Stress, Strain, Dislocation density, Characterisation using XRD– Fourier transform infrared analysis – Elemental analysis — Scanning Electron Microscopy (SEM) — Transmission Electron Microscope (TEM)- Chemical etching – Vickers micro hardness – Basic principles and operations of AFM and STM - UV–Vis spectrometer—Photoluminescence spectrophotometer- Thickness measurement of thin fiom by profilometer.

TEXT BOOKS

1. **Crystal Growth Processes and Methods**, P.Shanthana Ragavan and P. Ramasamy , KRU Publications, 2001

Unit-I - Chapter.2 (**Sec**. 2.2,2.2.1,2.2.2.1-2.2.2.6 , 2.2.3, 2.2.3.1 , 2.2.3.2)

Unit- II - Chapter.4 (**Sec.**4.1,4.1.1- 4.1.3,4.1.3.1-4.1.3.3, 4.2, 4.2.1,4.2.2,4.8,4.8.1)

Unit- III – Chapter.3&5 (**Sec**. 3.2-3.4, Sec.5.1, 5.1.1 , 5.1.2, 5.1.2.1 , 5.1.2.2 , 5.4.1-5.4.7)

2. **Thin Film Fundamentals**, A. Goswami , New age International Pvt, 2014.

Unit- IV-Ch. 1 (Sec.1,2, 5, 6, 6.3, 6.4 , 7,7.1,7.2, 8, 8.1, 8.2,8.3)

Unit-V -C.R.Brundle,C. A.Evans and S.Wilson (Edn)

Encyclopedia of materials characterization, London(1992)

REFERENCE BOOKS:

1. A.Holden and P.Singer ,**Crystals and Crystal Growing**, - ValkisFeffer and Simons Pvt.
2. J.C. Brice, Crystal Growth Processes, John Wiley and Sons, New York (1986).
3. N.F.M.Henry, H.Lipson and W.A.Wooster **,The Interpretation of X - ray Diffraction Photographs-**,Macmillan & Co Ltd, 1969.
4. L.I.Maissel and R.Glang, **Handbook of Thin Film Technology**, McGraw Hill Book Company ,1970 .
5 K.L.Chopra ,**Thin Film Phenomena**, McGraw Hill Book Company , 1969.

Web Resources

1.https://acadpubl.eu/hub/2018-119-12/articles/2/489.pdf
2.https://www.researchgate.net/publication/229466529_Crystal_Growth
3.https://www.ndsu.edu/pubweb/~qifzhang/Tech_Sputter-01.pdf
4.https://www.alicat.com/thin-film-deposition-techniques/
5.https://www.aif.ncsu.edu/mct/
6.https://en.wikipedia.org/wiki/Characterization_(materials_science)

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I	Theories of nucleation – Classical theory of nucleation–	5	Lecture, Group discussion
	Gibbs Thomson equation for vapour, melt solution– Energy of formation of a nucleus–	5	Lecture, ICTand Assignment
	Spherical nucleus – Cylindrical nucleus– Heterogeneous Nucleation – Cap- shaped nucleus–Disc-shaped nucleus.	5	Lecture and Group discussion, seminar
UNIT II	Low temperature solution growth – Solution, solubility and supersolubility–Expression of supersaturation	5	Lecture and Group discussion, ICT
	Crystallization by slow cooling of solution–Crystallization by solvent evaporation–Temperature gradient method	5	Lecture and Group discussion,seminar
	Crystal growth system –Constant temperature bath – crystallizer- High temperature solution growth-principles of flux growth	5	Lecture , Group discussion and Assignment
UNIT III	Growth from the melt: Bridgeman Technique- container selection- Czochralski Technique-Vapour Growth–Physical Vapour Deposition–Chemical Vapour Deposition–Advantages of CVD–Disadvantages of CVD	6	Lecture , ICTand seminar
	Gel Growth–Principle–Various Types of Gel- Structure of gel–Growth of Crystals in gels–importance of gel Technique	4	Lecture, Group discussion and Seminar
	Experimental Procedure –Single and Double diffusion method–Chemical reduction method–Complex -decomplexion method–Solubility reduction method.	5	Lecture , ICT and Group discussion
UNIT IV	Introduction –Nature of Thin films — Electron beam method – Cathodic sputtering -Reactive sputtering- Radio Frequency Sputtering–	7	Lecture , ICT and Seminar
UNIT V	Crystallinity, Structural phase, Stress, Strain, Dislocation density, Characterisation using XRD– Fourier transform infrared analysis – Elemental analysis	7	Lecture , ICTand Group discussion
	Scanning Electron Microscopy (SEM) — Transmission Electron Microscope (TEM)-Chemical etching – Vickers micro hardness – Basic principles and operations of AFM and STM UV–Vis	8	Lecture , ICT and Group discussion

	spectrometer—Photoluminescence spectrophotometer- Thickness measurement of thin film by profilometer.		

Course Outcomes (Cos)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	4	4	4	4	3	4	3	4	3.7
CO2	4	3	4	3	4	4	3	4	3	4	3.6
CO3	4	4	3	4	3	4	4	3	4	4	3.7
CO4	4	3	4	3	4	4	4	3	4	4	3.7
CO5	4	4	3	4	4	4	3	4	4	4	3.8
Mean Overall Score											3.7

Result: The Score for this Course is 3.7 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = Total of Values / Total No. of Pos & PSOs	Mean Overall Score of COs = Total of Mean scores / Total No. of COs

ASSESSMENT RUBRICS

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 (Remembering/Recalling)	20%	20%
K2 (Understanding/Comprehension)	20%	20%
K3 (Application & Analysis)	30%	30%
K4 (Synthesis & Evaluation)	30%	30%

Course Designer: 1.DR.**G.**KRISHNA BAMA
2. DR. N.NAGARANI

Programme : M.Sc. **DSEC III**
Semester : III **Hours : 5 P/W 75Hrs P/S**
Sub. Code : P22DSP3B **Credits : 4**

TITLE OF THE PAPER: PLASMA PHYSICS

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL	ICT
	5	2	1	1	1

PREAMBLE: Explore the plasma universe by means of in-situ and ground-based observations, understand the model plasma phenomena in the universe and explore the physical processes which occur in the space environment.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1:define fundamental concepts about plasma	I	15
CO2: explain about the motion of charged particles	II	15
CO3: interpret the plasma oscillations and waves	III	15
CO4: predict about plasma diagnostics techniques	IV	15
CO5: explain about the applications of plasma physics	V	15

SYLLABUS

UNIT I: FUNDAMENTAL CONCEPTS ABOUT PLASMA

Debye shielding – Fundamental concepts - Kinetic pressure in a partially ionized – Mean free path and collision cross section – Mobility of charged particles – Effect of charged particles on the mobility of ions and electrons – Thermal conductivity – Dielectric constant of plasma – Optical properties of plasma.

UNIT II: MOTION OF CHARGED PARTICLES IN ELECTRIC AND MAGNETIC FIELD

Particle in a uniform magnetic field - Particle in the uniform electric and magnetic fields – Particle in the uniform force and uniform magnetic fields – Gravitational force – Curvature drift - Particle in a non uniform magnetic field – Grad-B drift – Curvature and Grad-B drifts - Magnetic mirrors - Particle in a time varying electric field and uniform magnetic field.

UNIT III: PLASMA OSCILLATIONS AND WAVES

Representation of waves – Group velocity of a wave – Linearization of equations – Linearization of equation of motion - Linearization of equation of continuity - Plasma oscillations – Plasma frequency - Electron plasma waves – Ion waves – Hydromagnetic waves – Magnetosonic waves.

UNIT IV: PLASMA DIAGNOSTICS TECHNIQUES

Single probe method –Determination of electron Temperature T_e - Determination of electron density n_e – limitations of the single probe method - Double probe method – Magnetic probe method - Sources of error in probe measurements - Microwave method – Reflection Method – Transmission Method - spectroscopic method – Electron temperature from the ratio of spectral line intensity.

UNIT V: POSSIBLE APPLICATIONS OF PLASMA PHYSICS

Magneto hydrodynamic Generator - Basic theory - Principle of Working – Faraday Generator – Generation of microwaves utilizing High density Plasma – Magnetosonic waves.

TEXT BOOK

1. Text book of Plasma Physics Suresh Chandra CBS Publisher & Distributor Pvt. Ltd., New Delhi, 2008.

Unit I-**Ch. 1** (Sec. 1.3,1.4,1.4.1,1.4.2,1.4.3,1.4.4,1.4.5,1.4.6,1.4.7)

Unit II-**Ch. 4** (Sec. 4.1,4.2,4.3,4.3.1,4.4,4.5,4.5.1,4.5.2,4.6,4.8)
Unit III-**Ch. 6** (Sec. 6.1,6.4,6.3,6.3.1,6.4,6.4.1,6.4.2,6.5,6.7,6.16,6.17)
Unit IV-**Ch. 3** (Sec. 3.1,3.1.1,3.1.2,3.1.3,3.2,3.3,3.3.1,3.4,3.4.1,3.4.2,3.6,3.6.1)
Unit V-**Ch. 11**(Sec. 11.2,11.2.1,11.2.2,11.2.3,11.3)

BOOKS FOR REFERENCE:

1. Introduction to Plasma Physics - F.F.Chen, Plenum Press, London
2. Principles of Plasma Physics - Krall &Trivelpiece
3. Introduction to Plasma Theory-D.R. Nicholson
4. Plasma Physics- Plasma State of Matter - S.N.Sen, PragatiPrakashan, Meerut.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I	Debye shielding – Fundamental concepts - Kinetic pressure in a partially ionized – Mean free path and collision cross section	5	Lecture, Peer teaching, GD & ICT
	Mobility of charged particles – Effect of charged particles on the mobility of ions and electrons	5	Lecture, Peer teaching, GD & ICT
	Thermal conductivity - Dielectric constant of plasma – Optical properties of plasma.	5	Lecture, Peer teaching, GD & ICT
UNIT II	Particle in a uniform magnetic field - Particle in the uniform electric and magnetic fields – Particle in the uniform force and uniform magnetic fields	5	Lecture, Peer teaching, GD & ICT
	Gravitational force – Curvature drift - Particle in a non uniform magnetic field – Grad-B drift – Curvature and Grad-B drifts	6	Lecture, Peer teaching, GD & ICT
	Magnetic mirrors -Particle in a time varying electric field and uniform magnetic field	4	Lecture, Peer teaching, GD & ICT
UNIT III	Representation of waves – Group velocity of a wave – Linearization of equations – Linearization of equation of motion	6	Lecture, Peer teaching, GD & ICT
	Linearization of equation of continuity - Plasma oscillations – Plasma frequency - Electron plasma waves	5	Lecture, Peer teaching, GD & ICT
	Ion waves – Hydromagnetic waves – Magnetosonic waves	4	Lecture, Peer teaching, GD & ICT
UNIT IV	Single probe method –Determination of electron Temperature T_e - Determination of electron density n_e – limitations of the single probe method	5	Lecture, Peer teaching, GD & ICT
	Double probe method – Magnetic probe method - Sources of error in	5	Lecture, Peer teaching, GD & ICT

	probe measurements - Microwave method		
	Reflection Method – Transmission Method - spectroscopic method – Electron temperature from the ratio of spectral line intensity	5	Lecture, Peer teaching, GD & ICT
UNIT V	Magneto hydrodynamic Generator - Basic theory	5	Lecture, Peer teaching, GD & ICT
	Principle of Working - Faraday Generator	5	Lecture, Peer teaching, GD & ICT
	Generation of microwaves utilizing High density Plasma - Magnetosonic waves	5	Lecture, Peer teaching, GD & ICT

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	3	4	3	3	4	3	3	5	3.5
CO2	5	3	4	3	4	3	3	4	3	4	3.6
CO3	3	3	3	4	3	3	5	4	3	3	3.4
CO4	3	3	4	3	3	3	4	4	3	4	3.4
CO5	4	3	3	4	4	3	3	4	4	3	3.5
Mean Overall score											3.48

Result: The Score for this Course is 3.48 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = Total of Value / Total No. of POs& PSOs	Mean Overall Score of COs = Total of Mean Score / Total No. of COs

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 (Remembering/Recalling)	20%	20%
K2 (Understanding/Comprehension)	20%	20%
K3 (Application & Analysis)	30%	30%
K4 (Synthesis & Evaluation)	30%	30%

Course Designer : Dr.M. Mahalakshmi, Department of Physics

Programme : M.Sc | **Part III: NME- I**
Semester : III | **Hours : 2 Hrs/W**
Sub. Code : P22NMP1 | **Credits : 2**

TITLE OF THE PAPER: BATTERIES AND THEIR APPLICATIONS

Pedagogy per unit	**Hours**	**Lecture**	**Peer Discussion/Teaching**	**GD/VIDOES/TUTORIAL**	**ICT**
	2	1	-	-	1

PREAMBLE: To understand the Working Principles and types of battery cells

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1 : To describe the Working Principles of batteries	I	6
CO2 : To Impart the knowledge RECHARGEABLE BATTERIES	II	6
CO3 : To Analyse the Material used	III	6
C04 : To understand the. Primary and Secondry batteries	IV	6
CO5 : To understand the Theory of Batteries Installation.	V	6

SYLLABUS

UNIT - I BASICS OF BATTERIES

Battery- Working Principles –Types – Primary and Secondry batteries

UNIT - II TYPES OF BATTERY CELLS

Cylindrical cell-Button cell-PRISMATIC CELL –Pouch cell

UNIT- III RECHARGEABLE BATTERIES

Charecteristics of Nickal Cadmium Battery -Nickal Metal Hydride Battery -Lead Acid Battery-Lithium Ion Battery-Lithium Ion Polymer Battery

UNIT-IV LEAD ACID BATTERY AND NICKAL CADMIUM BATTERY

Lead Acid Batteyr- Working -Material used –Advantages and Disadvantages –Nickal Cadmiium Battery Working -Material used –Advantages and Disadvantages

UNIT V-BATTERIES AND INVERTERS

Batteries- Batteries Installation – Maintanance and disposal- Inverter Installation Grid Connected Inverters –Battery Charging

Text book

Material Prepared by the Department

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
Unit I	Battery- Working Principles –Types –Primary and Secondry batteries	**6 hrs**	Motivation by asking questions – peer group discussion and by demonstrating through ICT. Lecture & Tutorial
Unit II	Cylindrical cell-Button cell-PRISMATIC CELL –Pouch cell	**6 hrs**	Motivation by asking questions – peer group discussion and by demonstrating through ICT. Lecture & Tutorial
Unit III	Charecteristics of Nickal Cadmium Battery -Nickal Metal Hydride Battery -Lead Acid Battery-	**3 hrs**	Motivation by asking questions – peer group discussion and by demonstrating through ICT.
	Lithium Ion Battery- Lithium Ion Polymer Battery	**3 hrs**	Lecture & Tutorial
Unit IV	Lead Acid Battery Working -Material used –Advantages and Disadvantages –Nickal Cadmiium Battery Working -Material used –Advantages and Disadvantages	**6 hrs**	Motivation by asking questions – peer group discussion and by demonstrating through ICT.
Unit V	Batteries Installation – Maintanance and disposal- Inverter Installation Grid Connected Inverters – Battery Charging	**6 hrs**	Motivation by asking questions – peer group discussion and by demonstrating through ICT.

Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean scores of Cos**
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	3	3	3	3	4	4	3	3	3.3
CO2	3	3	4	4	3	3	3	3	3	4	3.3
CO3	3	4	3	3	3	4	3	4	3	3	3.3
CO4	3	3	3	4	3	4	3	4	3	3	3.3
CO5	4	3	4	4	4	3	4	4	4	3	4.0
Mean Overall Score											3.5

Result: The Score for this Course is **3.5** (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5

<table>
<tr><td>Relation</td><td>0.0-1.0</td><td>1.1-2.0</td><td>2.1-3.0</td><td>3.1-4.0</td><td>4.1-5.0</td></tr>
<tr><td>Quality</td><td>Very Poor</td><td>Poor</td><td>Moderate</td><td>High</td><td>Very High</td></tr>
<tr><td colspan="3">Mean Score of COs = Total of Value / Total No. of POs & PSOs</td><td colspan="3">Mean Overall Score of COs = Total of Mean Score / Total No. of COs</td></tr>
</table>

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1:REMEMBERING/RECALLING.	20%	20%
K2:UNDERSTANDING / COMPREHENSION.	20%	20%
K3:APPLICATION AND ANALYSIS.	30%	30%
K4:SYNTHESIS AND EVALUATION.	30%	30%

Programme : M.Sc | **Part III: Core - XII**
Semester : III | **Hours : 6Hrs**
Sub. Code : P22CP12P | **Credits: 3**

TITLE OF THE PAPER: PHYSICS PRACTICAL - III

PREAMBLE: The Objective of this course is to make the students gain practical knowledge in non-electronics experiments

COURSE OUTCOME

At the end of the Semester, the Students will be able to

CO1: Apply the various procedures and techniques for the experiments

CO2: Discuss the basic principle of the experiments

CO3: learn the usage of electrical and optical systems for various measurements

CO4: Apply the analytical techniques and graphical analysis to the experimental data.

CO:5 Apply the mathematical concepts to obtain quantitative results

ANY SEVEN EXPERIMENTS

LIST OF EXPERIMENTS

1. Hall Effect-Determination of hall voltage, carrier density and carrier mobility of the given Ge crystal.
2. Ultrasonic Interferometer-Determination of ultrasonic velocity and compressibility of distilled water
3. Determination of Young's modulus and Poisson's ratio of the given glass plate by employing elliptical fringes.
4. Determination of dielectric constant for solid
5. Study of specific rotation – Polarimeter
6. Determination of particle size using laser
7. Determination of wavelength of a laser source using diffraction grating.
8. Determination of curie temperature, energy loss, and to trace the hysteresis (B-H) loop of a ferromagnetic specimen.
9. Determination of width of the single slit of a laser source using diffraction grating.
10. Determination of width of the double slit of a laser source using diffraction grating.
11. Determination of the numerical aperture of the given fiber
12. Measurement of bending loss of the given fiber
13. Relative measurement of splice loss of the given fiber

Programme : M.Sc. | **CC : XIII**

Semester : IV **Hours : 6 Hrs P/W 90 Hrs P/S**
Sub. Code : P22CP13 **Credits : 4**

TITLE OF THE PAPER: CONDENSED MATTER PHYSICS - II

Pedagogy	Hours	Lecture	Peer Teaching	GD/Videos/Tutorial	ICT
	6	3	1	1	1

PREAMBLE: Develop analytical thinking to understand the phenomenon that decide various properties of solids thereby equip students to pursue higher learning confidently.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S
CO1: interpret the theory of dielectrics	I	18
CO2: explain about the theory of ferroelectrics and piezoelectrics	II	18
CO3: define the magnetic properties of the materials	III	18
CO4: predict about Superconductivity and its types	IV	18
CO5: explain about the Plasmons, Polaritons and Excitons	V	18

SYLLABUS

UNIT I: THEORY OF DIELECTRICS

Introduction - Dipole moment – Polarization – Electric field of a dipole - Local electric field at an atom - Depolarization field – Lorentz field - Fields of dipoles inside the cavity - Dielectric constants and its measurements – Electronic Polarizability – Ionic polarizability - Classical theory of electronic polarizability – Dipolar polarizability.

UNIT II: THEORY OF FERROELECTRICS AND PIEZO ELECTRICS

Ferroelectric Crystals – Classifications of Ferroelectric crystals – Displacive transitions – Soft Optical Phonons - Landau Theory of the phase transition – Second order Transition – First Order Transition – Antiferro electricity –Ferroelectric domains -Piezo electricity.

UNIT III: MAGNETIC PROPERTIES OF MATERIALS

Langevin's diamagnetism Equation – Quantum theory of diamagnetism - paramagnetism – Quantum theory of paramagnetism –Ferromagnetic order – Curie point and the Exchange integral – Curie-Weiss law - Temperature dependence of Saturation Magnetization – Ferri magnetic order – Anti ferromagnetic order - Ferromagnetic domains – Anisotropy Energy.

UNIT IV: SUPERCONDUCTIVITY

Occurence of super conductivity - Destruction of super conductivity by magnetic fields - Meissner Effect – Type I and Type II Super conductors - Heat Capacity - Energy gap - Microwave and infrared properties - Isotope effect - Thermodynamics of the superconducting transition - London equation - Coherence Length - BCS theory of superconductivity, BCS ground state - Flux quantisation in a super conduction ring - Duration of persistence currents - Single particle tunnelling - DC Josephson effect - AC Josephson effect - Macroscopic quantum interference – High temperature super conductors – Applications.

UNIT V: PLASMONS, POLARITONS AND POLARONS

Plasma optics, Disperson relation for EM waves—Transverse & Longitudinal mode of plasma oscillations-Plasmons – Polaritons – Electron-Electron interaction – Electron- Phonon Interaction - Polarons – Optical reflectance – Excitons - Frenkel excitons - Weakly bound excitons.

BOOKS FOR STUDY:

1. Solid State Physics – Structure and Properties of Materials, M. A. Wahab,. Narosa, New Delhi, 1999.
   Unit I - Ch.14 (Sec. 14.1-14.9)
2. Introduction to Solid State Physics, Charles Kittel, VII Edition Wiley India Pvt. Ltd., 2011.
   Unit II - Ch. 16 (pg. 467-481)
   Unit III - Ch. 11 &12 (pg. 299-304,323,326,336,340-342,346-348)
   Unit IV - Ch. 10 (pg. 260-293)
   Unit V - Ch.10 & 11 (pg. 272-279, 287-291, 294-299, 307,308, 312-319)

BOOK FOR REFERENCE:

1. Electrical Engineering Materials, A. J. Dekker, Prentice Hall of India, 1975.
2. Problems and Solutions in Solid State Physics, S.O. Pillai, New Age international Publishers, New Delhi, 1994.
3. Elementary Solid State Physics – Principles and Applications, M. Ali Omar, Pearson,1999.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I	Introduction - Dipole moment – Polarization – Electric field of a dipole - Local electric field at an atom	6	Lecture, Tutorial, Peer Teaching & ICT
	Depolarization field – Lorentz field - Fields of dipoles inside the cavity - Dielectric constants and its measurements	5	Lecture, Tutorial, Peer Teaching & ICT
	Electronic Polarizability – Ionic polarizability - Classical theory of electronic polarizability – Dipolar polarizability.	7	Lecture, Tutorial, Peer Teaching & ICT
UNIT II	Ferroelectric Crystals – Classifications of Ferroelectric crystals – Displacive transitions – Soft Optical Phonons	7	Lecture, Tutorial, Peer Teaching & ICT
	Landau Theory of the phase transition – Second order Transition – First Order Transition	6	Lecture, Tutorial, Peer Teaching & ICT
	Antiferroelectricity - Ferroelectric domains - Piezoelectricity	5	Lecture, Tutorial, Peer Teaching & ICT
UNIT III	Langevin's diamagnetism Equation – Quantum theory of diamagnetism - paramagnetism – Quantum theory of paramagnetism	6	Lecture, Tutorial, Peer Teaching & ICT
	Ferromagnetic order – Curie point and the Exchange integral – Curie-Weiss law - Temperature dependence of Saturation Magnetization	6	Lecture, Tutorial, Peer Teaching & ICT
	Ferrimagnetic order – Antiferromagnetic order - Ferromagnetic domains – Anisotropy Energy	6	Lecture, Tutorial, Peer Teaching & ICT
	Occurence of super conductivity - Destruction of super conductivity by magnetic fields - Meissner Effect – Type I and Type II Super conductors - Heat Capacity - Energy gap - Microwave and infrared properties	6	Lecture, Tutorial, Peer Teaching & ICT

UNIT IV	Isotope effect - Thermodynamics of the superconducting transition - London equation - Coherence Length - BCS theory of superconductivity, BCS ground state - Flux quantisation in a super conduction ring	6	Lecture, Tutorial, Peer Teaching & ICT
	Duration of persistence currents - Single particle tunnelling - DC Josephson effect - AC Josephson effect - Macroscopic quantum interference – High temperature super conductors – Applications	6	Lecture, Tutorial, Peer Teaching & ICT
UNIT V	Plasma optics, Disperson relation for EM waves—Transverse&Longitudinal mode of plasma oscillations	6	Lecture, Tutorial, Peer Teaching & ICT
	Plasmons – Polaritons – Electron-Electron interaction – Electron- Phonon Interaction	6	Lecture, Tutorial, Peer Teaching & ICT
	Polarons – Optical reflectance – Excitons - Frenkel excitons- weakly bound excitons	6	Lecture, Tutorial, Peer Teaching & ICT

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	3	4	3	3	4	3	3	5	3.5
CO2	5	3	4	3	5	4	3	4	3	3	3.7
CO3	3	3	4	3	3	3	4	4	3	4	3.4
CO4	3	3	4	3	3	3	5	4	3	4	3.5
CO5	4	3	3	4	4	3	3	4	4	3	3.5
Mean Overall Score											3.52

Result: The Score for this Course is **3.52** (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = Total of Value / Total No. of POs & PSOs	Mean Overall Score of COs = Total of Mean Score / Total No. of COs

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 - Remembering/Recalling	20%	20%
K2 - Understanding/Comprehension	20%	20%
K3 - Application & Analysis	30%	30%
K4 - Synthesis & Evaluation	30%	30%

Course Designer: Dr.M. Mahalakshmi, Department of Physics

Programme : M.Sc.
Semester : IV
Sub. Code : P22CP14

Core : XIV
Hours : 6 P/W 90 Hrs P/S
Credits : 4

TITLE OF THE PAPER: NUCLEAR AND PARTICLE PHYSICS

Pedagogy	Hours	Lecture	Peer Teaching	GD/ Videos/Tutorial	ICT
	6	3	1	1	1

PREAMBLE: The course of nuclear physics imparts knowledge about nuclear forces and nuclear reactions with the help of nuclear models and explains the classification of elementary particles and their interactions.

COURSE OUTCOME At the end of the semester, the students will be able to	Unit	Hrs P/S
CO1: explain general properties of nucleus, central and non central nuclear forces..	I	18
CO2: describe the theories and models of nucleus.	II	18
CO3: list out the types of nuclear reactions and transmutations.	III	18
CO4: discuss radioactive decays	IV	18
CO5: explain the concept of elementary particles.	V	18

SYLLABUS

UNIT I : NUCLEAR FORCES

Neutron Proton Scattering at low energies – Partial wave analysis – scattering length - Spin dependence of Nuclear Forces - coherent Scattering of slow neutrons – Effective range theory of n-p scattering at low energies - Saturation of Nuclear Forces – Exchange forces – Non Central Forces - Experimental evidence – General form – properties- Ground state of deuteron - Magnetic moment - Quadrupole moment –Meson theory of nuclear forces.

UNIT II : NUCLEAR MODELS

Binding energy & mass defect – Weizacker's formula – mass parabola - Liquid drop model - Shell model- Spin –Orbit coupling-Spins of nuclei- Magnetic moments – Schmidt lines- Electric quadrupole moments - Collective model of Bohr and Mottelson: Nuclear vibration – Nuclear rotation –Nelson model.

UNIT III : NUCLEAR REACTIONS

Types of Nuclear Reactions - Nuclear reaction kinematics – Partial wave analysis of Nuclear reaction cross-section - Compound nucleus – Energy levels of Nuclei - Level width and De-excitation Formation –Disintegration of Compound nucleus - Resonance Scattering and Reaction cross-section (Breit-Wigner dispersion formula)- Resonance Cross sections – elastic resonance scattering - Low energy Neutron reactions - Direct Reactions - Stripping reaction.

UNIT IV : RADIOACTIVE DECAYS

Alpha decay - Beta decay –Energy release in beta decay – Fermi theory of beta decay – Shape of the beta spectrum – decay rate Fermi-Curie plot – Fermi & G.T Selection rules - Comparatives half - lives and forbidden decays- Gama decay - Multipole radiation – Angular momentum and parity selection rules – Internal conversion – Nuclear isomerism.

UNIT V: ELEMENTARY PARTICLE PHYSICS

Classification of elementary particles- Types of interaction between elementary particles – Elementary concepts of weak interactions – conservation laws–Strangeness and associate production- CPT theorem - Elementary Particles Symmetries – Iso spin multiples - SU(2)- SU(3) multiplets- Gell-Mann - Okubo mass formula - octet and de cuplet hadrons.

TEXT BOOK:

Nuclear Physics, D.C.Tayal, 5th edition, Himalaya Publishing House, 2012.

Unit I - **Ch.8** (Sec.8.3, 8.8 ,8.12).

Unit II - **Ch. 1 & 9** (Sec. 1.6, 9.3, 9.4 (4 & 5), 9.5, 9.6).

Unit III - **Ch.10** (Sec. 10.1, 10.3, 10.9, 10.15 , 10.17, 10.20 , 10.24) .

Unit IV - **Ch.5,6 &7** (Sec.5.5, 6.1, 6.2, 6.5, 6.6, 7.3, 7.4, 7.6).

Unit V - **Ch.18** (Sec.18.2,18.3, 18.4 , 18.18).

REFERENCE BOOKS

1. Nuclear Physics, Irving Kaplan, , 2nd edition, Narosa Publishing company, 1987.
2. Nuclear Physics-An Introduction S.B.Patel **,** , 2nd edition, Narosa International Publishers, 2011.
3. Introduction to Nuclear and Particle Physics V.K.Mittal,R.C.Verma, S.C.Gupta , 2nd edition, PHI LearingPvt Ltd, 2011.
4. Nuclear Physics , V.Devanathan **,** , 2nd edition , Narosa Publishing House, 2012.

UNITS	**TOPIC**	**LECTURE HOURS**	**MODE OF TEACHING**
UNIT I	Neutron Proton Scattering at low energies, Partial wave analysis, scattering length, Spin dependence of Nuclear Forces, coherent Scattering of slow neutrons.	6	Lecture, Peer teaching, GD, ICT
	Effective range theory of n-p scattering at low energies, Saturation of Nuclear Forces, Exchange forces, Non Central Forces, Experimental evidence, General form.	6	Lecture, Peer teaching, GD, ICT
	Properties, Ground state of deuteron, Magnetic moment, Quadrupole moment, Meson theory of nuclear forces.	6	Lecture, Peer teaching, GD, ICT
	Binding energy & mass defect, Weizacker's	6	Lecture, Peer

UNIT II	formula, mass parabola, Liquid drop model		teaching, GD, ICT
	Shell model, Spin , Orbit coupling, Spins of nuclei, Magnetic moments, Schmidt lines	6	Lecture, Peer teaching, GD, ICT
	Electric quadrupole moments - Collective model of Bohr and Mottelson: Nuclear vibration – Nuclear rotation –Nelson model.	6	Lecture, Peer teaching, GD, ICT
UNIT III	Types of Nuclear Reactions, Nuclear reaction kinematics, Partial wave analysis of Nuclear reaction cross-section.	6	Lecture, Peer teaching, GD, ICT
	Energy levels of Nuclei, Level width and De-excitation Formation, Disintegration of Compound nucleus, Resonance Scattering and Reaction cross-section (Breit-Wigner dispersion formula).	6	Lecture, Peer teaching, GD, ICT
	Compound nucleus Resonance Cross section, elastic resonance scattering, Low energy Neutron reactions, Direct Reactions, Stripping reaction.	6	Lecture, Peer teaching, GD, ICT
UNIT IV	Alpha decay, Beta decay, Energy release in beta decay, Fermi theory of beta decay, Shape of the beta spectrum.	6	Lecture, Peer teaching, GD, ICT
	decay rate Fermi-Curie plot, Fermi & G.T Selection rules, Comparatives half - lives and forbidden decays, Gama decay.	6	Lecture, Peer teaching, GD, ICT
	Multipole radiation, Angular momentum and parity selection rules – Internal conversion, Nuclear isomerism.	6	Lecture, Peer teaching, GD, ICT
UNIT V	Classification of elementary particles- Types of interaction between elementary particles, Elementary concepts of weak interactions.	6	Lecture, Peer teaching, GD, ICT
	conservation laws, Strangeness and associate production, CPT theorem , Elementary Particles Symmetries .	6	Lecture, Peer teaching, GD, ICT
	Iso spin multiples, SU(2)- SU(3) multiplets, Gell-Mann, Okubo mass formula, octet and de cuplet hadrons.	6	Lecture, Peer teaching, GD, ICT

Course Outcomes (Cos)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	2	3	3	4	3	3	2	4	3.2
CO2	4	3	2	2	4	4	3	3	2	4	3.1
CO3	4	4	3	3	3	4	3	3	3	3	3.3
CO4	4	3	2	3	3	4	3	2	3	3	3.0
CO5	4	4	3	3	4	4	3	3	2	4	3.4
Mean Overall Score											3.16

Result: The Score for this Course is 3.16 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value / Total No. of Pos & PSOs			Mean Overall Score of COs = Total of Mean Score / Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
K1 (Remembering/Recalling)	20%	20%
K2 (Understanding/Comprehension)	20%	20%
K3 (Application & Analysis)	30%	30%
K4 (Synthesis & Evaluation)	30%	30%

Course Designer: Dr.R.Vijayalakshmi, Department of Physics

Programme :M.Sc PHYSICS
Semester : IV
Sub code : P22DSP4A

PART III : ELECTIVE - IV
Hours : 5Hrs P/W, 75HrsP/Sem.
Credits : 4

TITLE OF THE PAPER : LASER AND NONLINEAR OPTICS

Pedagogy	Hours	Lecture	Peer teaching	TUTORIAL	ICT
	5	2	1	1	1

PREAMBLE :

The aim of this course is to give a reasonably comprehensive introduction to the fundamental concepts, mathematical formalism and working principles of lasers, nonlinearmaterials , nonlinear optics and fibre optics. Effort has been taken to make this course more upto date with latest developments in laser and nonlinear optics.

COURSE OUTCOME At the end of the Semester, the students will be able to	**UNIT**	**Hrs P/S**
CO1- LASERS Acquire knowledge about various types of lasers, understand the basic principles and working of lasers , predict the type of laser that can be used in various applications.	1	15
CO2- BASICS OF NONLINEAR OPTICS Know about nonlinear optics , understand harmonic generation, phase matching , optical mixing , differentiate linear and nonlinear optics , determine the length at which self focusing occurs.	2	15
CO3-MULTIPHOTON PROCESS Know about multi quantum photoelectric effect, understand the production of two photons ,three photons, parametric generation of light, apply frequency mixing in frequency up conversion, analyse Raman scattering.	3	15
CO4- NON LINEAR OPTICAL MATERIALS Know basic requirements of non linear materials, interpret various nonlinear materials, use of various nonlinear materials	4	15
CO5-FIBER OPTICS Know different types of fibres, understand wave propagation and fibre modes, determine numerical aperture, fibre losses, attenuation, determine role of band width , differentiate fibre modes and dispersion	5	15

SYLLABUS

UNIT I: LASERS

Gas lasers : He-Ne laser – Solid state lasers : Ruby laser , Nd : YAG laser – Organic dye laser – Semiconductor lasers : p-n-junction laser and GaAs laser.

UNIT II: BASICS OF NONLINEAR OPTICS

Wave propagation in an anisotropic crystal : Polarization response of materials to light – Harmonic generation – Second harmonic generation – Sum and difference frequency generation– Phase matching – Third harmonic generation – Self-focusing of light

UNIT III: MULTIPHOTON PROCESSES

Multi quantum photoelectric effect - Two photon process – experiment ($CaF_2:Eu^{++}$ doped crystals, Cesium vapour) – Three photon process – Parametric generation of light –parametric light oscillator – Amplifier(frequency up conversion)

UNIT IV: NONLINEAR OPTICAL MATERIALS

Basic requirements – Inorganics – Borates – Organics – Urea, Nitroaniline –Semiorganics – Thoreau complex .

UNIT V: FIBER OPTICS

Step – Graded index fibres – Wave propagation - Fibre modes – Single and multimode fibres – Numerical aperture - Fibre losses - Scattering, absorption, bending – Attenuation coefficient - Dispersion – Fibre band width

BOOKS FOR STUDY

1. Anuradha De, Optical fibre and Laser , 2nd Edition.(New age international publishers,2010)
   Unit - I : page no. (77-83)
   Unit – V : page no. (23-28, 32-34, 43-45,48-51, 55)
2. B.B. Laud, Lasers and Nonlinear Optics, 3rd Edition(New Age, New Delhi, 2011).
   Unit – II : page no. (191-202)
   Unit – III : page no. (203-205,209-211, 214-217)
3. R.W. Boyd, Nonlinear Optics, 2nd Edition. (Academic Press, New York, 2003).
4. G.P. Agarwal, Fibre-Optics Communication Systems, 3rd Edition. (John Wiley, Singapore, 2003).

BOOKS FOR REFERENCE:

1. W.T. Silvast, Laser Fundamentals (Cambridge University Press, Cambridge, 2003).
2. D.L. Mills, Nonlinear Optics – Basic Concepts (Springer, Berlin, 1998).

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT – I	Gas laser – He-Ne laser	3	L,P,T
	Solid state laser – Ruby laser	3	L,I,T
	Nd: YAG laser	2	L,T
	Organic dye laser	2	L,I
	Semiconductor laser –p-n junction laser	3	L,P,I
	GaAs laser	2	L,P
UNIT-II	Wave propagation in an anisotropic crystal – polarization response of materials to light	2	I,P
	Harmonic generation	2	L,T
	Second harmonic generation	2	L,P
	Sum and difference frequency generation	2	L,I
	Phase matching	2	L,T
	Third harmonic generation	2	L,P
	Self focusing of light	3	L,I,T
UNIT-III	Multi quantum photoelectric effect	2	L,I
	Two photon process	2	L,T
	Experiment – CaF:Eu++ doped crystal	2	L,I
	Experiment – Cesium vapour	2	L,I
	Three photon process	2	P,T
	Parametric generation of light	2	L,T
	Parametric light oscillator	2	L,I
	Amplifier (frequency up conversion)	1	P,T
	Basic requirements	2	L,P
	Inorganics	3	L,I,T
	Borates	2	L,T

UNIT IV	Organics – urea, nitroaniline	3	L,T,P
	Semiorganics	2	L,I
	Thoreau complex	3	L,I,P
UNIT-V	Step index fibre, graded index fibre	2	L,T
	Wave propagation in single mode, multimode fibre	3	L,P,T
	Numerical aperture	2	L,T
	Fibre losses – scattering, absorption, bending	2	L,I
	Attenuation coefficient	2	P,I
	Dispersion	2	L,I
	Fibre band width	2	L,P

Course outcomes	**Programme outcomes**					**Programme specific outcomes**					**Mean scores**
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO5**	
CO1	5	5	4	4	4	5	4	4	4	3	4.2
CO2	5	4	4	3	4	5	4	5	3	3	4.0
CO3	5	5	4	4	4	5	5	3	3	3	4.1
CO4	5	5	3	3	3	5	4	4	3	3	3.8
CO5	5	5	4	3	3	5	5	4	4	3	4.1
Mean overall score											4.04

Result : The Score for this course is 4.04 - High

BLOOM'S TAXANOMY	**INTERNAL**	**EXTERNAL**
KNOWLEDGE	50%	50%
UNDERSTANDING	30%	30%
APPLY	20%	20%

Course Designer :Dr.J.S.P.CHITRA, Department of PHYSICS

Programme :M.Sc PHYSICS **PART III : ELECTIVE - IV**
Semester : IV **Hours : 5Hrs P/W, 75HrsP/Sem.**
Sub code : P22DSP4B **Credits : 4**

TITLE OF THE PAPER : INTRODUCTION TO BOSE-EINSTEIN CONDENSATION (BEC), SUPERFLUIDITY, SUPERCONDUCTIVITY

Pedagogy	**Hours**	**Lecture**	**Peer teaching**	**TUTORIAL**	**ICT**
	5	**2**	**1**	**1**	**1**

PREAMBLE :

To educate students on the interesting macroscopic quantum phenomena and motivate them to pursue higher learning in the areas of BEC and superfluidity.

COURSE OUTCOME At the end of the Semester, the students will be able to	**UNIT**	**Hrs P/S**
CO1 Acquire knowledge about density of states, understand transition temperature, differentiate condensed phase and normal phase	1	15
CO2 Know about coherent states , understand bosonic quantum fields , analyse gross-Pitaevski equation	2	15
CO3 Know about elementary excitations, understand quasi particle spectrum, apply Hartree-Fock theory.	3	15
CO4 Know basic requirements , interpret classical and quantum fields nonlinear materials, determine thermal de Broglie wavelength	4	15
CO5 Know basic properties of superconductors, understand mean field Hamiltonian, discuss BCS ground state and excited state, interpret BCs theory at non-zero temperature	5	15

SYLLABUS

UNIT-I : THE IDEAL BOSE GAS

The Bose distribution function – density of states - transition temperature and condensate fraction – density profile and velocity distribution - thermodynamic properties of ideal Bose gas – condensed phase and normal phase - Specific heat close to Tc.

UNIT-II : THE MEAN FIELD THEORY OF WEAKLY INTERACTING BOSE GAS

Coherent states - Bosonic quantum fields – off diagonal long ranged order – weakly interacting Bose gas in the zero temperature limit: the Gross-Pitaevskii equation - BEC in ultra-cold atomic gases: an experimental overview and current status.

UNIT-III : MICROSCOPIC THEORY OF WEAKLY INTERACTING BOSE GAS

The Bogoliubov transformation – elementary excitations and quasiparticle spectrum – quantum depletion of the condensate number – Hatree-Fock theory

UNIT-IV : SUPERFLUID HELIUM II

Introduction - classical and quantum fluids – thermal de Broglie wavelength – Superfluid properties of Helium II – superflow property and fountain effect. Flow quantization and vortices.

UNIT-V : MICROSCOPIC THEORY OF SUPERCONDUCTIVITY

Introduction – basic properties of superconductors – the mean-field Hamiltonian - the BCS ground state – BCS excited states in the zero temperature limit – BCS theory at non-zero temperature.

BOOKS FOR STUDY:

1. Bose-Einstein Condensation in Dilute Gases by C. J. Pethick and H. Smith 2nd edition, Cambridge University Press, 2002.
2. Theory of Superconductivity by G. Rickayzen, Wiley-Interscience publisher, 1965.

BOOKS FOR REFERENCE:

1. Introduction to Statistical Physics by Kerson Huang 2nd edition, CRC press, 2001.
2. Lev P. Pitaevskii and S. Stringari, Bose–Einstein Condensation, Clarendon Press, Oxford, 2003.
3. Theory of Superconductivity, 1st edition by J. R. Schrieffer, Perseus B

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT – I	Bose distribution function	2	L,P
	Density of states	3	L,I,P
	Transition temperature and condensation fraction	2	L,I
	Density profile and velocity distribution	2	L,T
	Thermodynamic properties of ideal Bose gas	3	L,T,I
	Condensed phase and normal phase, specific heat close to Tc	3	L,P, T
UNIT-II	Coherent states, Bosonic quantum fields	2	I,P
	Off diagonal long ranged order	2	L,T
	Weakly interacting Bose gas in the zero temperature limit	2	L,P
	Gross-Pitaevski equation	2	L,I
	BEC in ultra cold atomic gases	2	L,T
	Experimental overview	2	L,P
	Current status	3	L,I,T
UNIT-III	Bogoliubov transformation	3	L,I,T
	Elementary excitations	3	L,T,I
	Quasi particle spectrum	3	L,I,P
	Quantum depletion of the condensate number	3	2L,I
	Hartree-Fock theory	2	P,T,L
UNIT IV	Introduction	2	L,P
	Classical and quantum fields	3	L,I,T
	Thermal de Broglie wavelength	2	L,T
	Super fluid properties of Helium II	3	L,T,P
	Super flow property and fountain effect	2	L,I

	Flow quantization and vortices	3	L,I,P
UNIT-V	Introduction	2	L,T
	Basic properties of superconductors	3	L,P,T
	Mean field Hamiltonian	2	L,T
	BCS ground states	2	L,I
	BCS excited states in the zero temperature limit	3	L,P,I
	BCS theory at non-zero temperature	3	L,I,P

Course outcomes	Programme outcomes					Programme specific outcomes					Mean scores
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO5	
CO1	5	5	4	3	4	5	4	4	3	3	4.0
CO2	5	4	4	3	4	5	4	5	3	3	4.0
CO3	5	5	4	4	4	5	5	3	3	3	4.1
CO4	5	5	4	3	3	5	4	4	3	3	3.9
CO5	5	5	4	3	3	5	5	4	3	3	4.0
Mean overall score											4.0

Result : The Score for this course is 4.0 - High

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	50%	50%
UNDERSTANDING	30%	30%
APPLY	20%	20%

Course Designer : Dr.J.S.P.CHITRA, Department of PHYSICS

PROJECT

CORE (XVI)

Code : P22CPPW **Credit : 5**

8 Hrs/Week

Each Student has to do a project during fourth semester under the guidance of a faculty and has to submit progress report every fortnight. The project work has to be submitted by the students by the end of March in a standard format. The Project will be evaluated jointly by an external examiner and the guide for 100 marks.

Programme : M.Sc **Part III: Core paper**
Semester : IV **Hours : 5P/W 75Hrs P/S**
Sub. Code : P22CP15P **Credits : 4**

TITLE OF THE PAPER: PHYSICS PRACTICAL PAPER - IV

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL	ICT
	6	4	-	2	-

PREAMBLE: The purpose of the *course* is to make the students to construct electronic circuits using ICs and study their behavior and applications.

COURSE OUTCOME

At the end of the Semester, the Students will be able to

CO1: construct electronic circuits using ICs

CO2: simplify arithmetic Expression using K maps

CO3: construct parity generator and checker using ICs

CO4: understand the theoretical concepts by doing experiments

CO5: understand the applications of 555 Timer & IC 741

S.NO	EXPERIMENT
1.	Magnitude comparator
2.	Multiplexer and Demultiplexer
3.	Odd &Evenparity generator and checker (IC 7486,7404)
4.	Gray to BCD and BCD to Gray code
5.	Boolean Expression using K map
6.	Full adder and Subtractor using ICs
7.	Even parity generator and checker (IC 7486)
8.	Analog to Digital Converter
9.	Digital to Analog Converter
10	Encoder and Decoder
12.	Astable Multivibrator using IC 555
13.	Schmit Trigger using IC 555
14.	Mod-n Counter using IC 7490
15.	Shift Register
16.	Low Pass and High Pass Filter using IC 741