HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)
Re-Accredited with A++ Grade by NAAC (3rd Cycle)
Uthamapalayam - 625 533.

PG & RESEARCH DEPARTMENT OF PHYSICS

MASTER OF SCIENCE - PHYSICS

SYLLABUS

Choice Based Credit System – CBCS

With

Outcome Based Education (OBE)

(Academic Year 2026 - 2027 onwards)

HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)
Re - Accredited with A++ Grade by NAAC (3rd Cycle)
Uthamapalayam - 625 533.

College Vision and Mission

Vision

Our vision is to provide the best type of higher education to all, especially to students hailing from minority Muslim community, rural agricultural families and other deprived, under privileged sections of the society, inculcating the sense of social responsibility in them. Our college is committed to produce talented, duty- bound citizens to take up the challenges of the changing times.

Mission

Our mission is to impart and inculcate social values, spirit of service and religious tolerance as envisioned by our beloved Founder President Hajee Karutha Rowther.

The Vision beckons ..... the Mission continues forever.

HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)
Re - Accredited with A++ Grade by NAAC (3rd Cycle)
Uthamapalayam - 625 533.

Department Vision and Mission

Vision

To thrive for the truth of nature in terms of agreements of theory with practice and stand firm even if ideas fail till new notions are formed. Physics portraits the landscape of life and this department look forward to explore the physics lying beneath our observations.

Mission

The mission of this department is to teach and learn physics in a collaborative, performance – based pathway; we look to encourage the students towards observation and analysis of the natural world and to provide the tools and skills to the students to be torch bearers of physics by contributing effectively to the existing laws of nature.

Programme Educational Objectives (PEO)

Our graduates will be progressive, efficient, value based, academically excellent, creative, collaborative, empowered and globally competent literates with the skills required for societal change.

They will demonstrate

PEO1	Comprehensive knowledge and expertise, employability, the acumen of creative and critical thinking, the spirit of enquiry and professional attitude required for a successful career
PEO2	Accountability, linguistic competence and communication skills in the work environment and beyond
PEO3	Perseverance, effective collaboration, team spirit, leadership and problem solving skills
PEO4	Keen sense of civility, professional ethics, receptivity and moral righteousness
PEO5	Commitment to address social and environmental threats and to act as responsible service-minded, duty-bound global citizens

Programme Outcomes (PO)

On the successful completion of M. Sc., Physics programme, the students will be able to

PO1	Acquire knowledge of physics.
PO2	Understand the usage of physics in applied sectors.
PO3	Apply skills through Practical's in laboratories, lab visits in research institution and field visits in industries.
PO4	Analyses motivated for pursuing higher education & research.
PO5	Evaluate skilled either to suit with employment opportunities or to make self-employments.

Program Specific Outcomes (PSO)

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

PSO1	Impart quality education in physics to students so as they become globally competitive physicist.
PSO2	Make the students to accept the challenges in physics and can effectively disseminate the physics knowledge to coming generations.
PSO3	Create strong interest in physics so as students can further develop themselves through self-study.
PSO4	Create a sense of ethical responsibilities among students.
PSO5	Participate and succeed in various state, national and international level competitive examinations to get suitable employment in government and global research sectors.

Programme Scheme

Eligibility

A candidate who has passed B.Sc., as the Major subject with Mathematics & Chemistry Ancillary is eligible for the Master of Science – Physics Degree.

Duration of the Course: M.Sc., Physics – 2 years (4 Semesters).

For Programme Completion

A Candidate shall complete:

- Part III - Core papers in semesters I, II, III and IV respectively
- Part III - Generic Elective papers in semesters I and II respectively
- Part III - Discipline Elective Papers in semesters III and IV respectively
- Part IV - Skill Enhancement Course (NME) Paper in Semester III respectively
- Part IV - Summer Internship/Industrial Training Paper in semester III respectively
- Part IV - Skill Enhancement Course (Professional Competency Skill) Paper in Semester IV respectively
- Part V - Extension activity in semester IV

Scheme of Examinations under Choice Based Credit System

Term End Examinations (TEE)	- 75 Marks
Continuous Internal Assessment Examinations (CIAE)	- 25 Marks
Total	- 100 Marks

Pattern of Continuous Internal Assessment Examinations (CIAE)

Average of Two Internal Tests (each 20 marks)	- 20 Marks
Assignment	- 05 Marks
Total	- 25 Marks

Pattern of Term End Examinations
(Max. Marks: 75 / Time: 3 Hours)

External Examinations Question Paper Pattern for Part III and Part IV (Non- Major Elective & Skill based Subject)

Section – A (10 X 2 = 20 Marks)

Answer ALL questions.

- Questions 1 - 10
- One question from each unit
- Short answer questions

Section – B (5 X 5 = 25 Marks)

Answer ALL questions (Choose either a or b).

- Questions 11 - 15
- One question from each unit
- Paragraph

Section – C (3 X 10 = 30 Marks)

Answer any THREE out of five questions.

- Questions 16 - 20
- One question from each unit
- Essay type

Part V (Extension Activities)

- Internal Evaluation only

Passing Marks

Minimum 34 for External Exam

Eligibility for the degree – passing minimum is **50%**

Practical Examination

Internal	– 40 marks
External	– 60 marks (minimum 27 marks)
Total	– 100 marks

Passing minimum is **50%**

Weightage

Weightage for Bloom's Taxonomy	Percentage	Marks	
		CIAE	TEE
Knowledge (Remembering) – K1	8	2	6
Understanding – K2	9	2	7
Applying – K3	12	3	9
Analyzing – K4	12	3	9
Evaluate – K5	40	10	30
Create – K6	19	5(Seminar)	14
Gross Total	**100**	**25**	**75**

Assessment

Distribution of questions and marks for Continuous Internal Assessment Examinations

Bloom's Taxonomy	Section A	Section B	Section C	Total
Knowledge(K1)	1(2)	-	**-**	**Total 25 marks**
Understanding(K2)	1(2)	**-**	**-**	
Apply(K3)	-	1(3)	-	
Analyzing (K4)	-	1(3)		
Evaluate (K5)	-	-	2(10)	
Create (K6)	**Seminar (5)**			

Distribution of questions and marks for Term End Examinations

Bloom's Taxonomy	Section A	Section B	Section C	Total
Knowledge(K1)	3(6)	-	-	**Total 75 Marks**
Understanding(K2)	1(2)	1(5)	-	
Apply(K3)	2(4)	1(5)	-	
Analyzing (K4)	2(4)	1(5)	-	
Evaluate (K5)	-	-	3(30)	
Create (K6)	2(4)	2(10)	-	

Note: Figures in parenthesis are Marks

Credits Distribution

S.No	Part	Category	No of Courses	No of Credits
1	Part - III	Core (Theory / Practical / Project)	15	72
		Discipline Elective (Theory / Practical)	2	6
		Generic Elective (Theory / Practical)	2	6
2	Part - IV	NME	1	2
		Professional Competency	1	2
		Internship	1	2
3	Part - V	Extension Activity	1	1
Total			**23**	**91**

M.Sc., PHYSICS

Details of Course Category, Code, Credits & Title

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits
Semester – I							
Part – III							
Core – I	26PPHCC11	Mathematical Physics – I	6	25	75	100	5
Core – II	26PPHCC12	Classical Dynamics	6	25	75	100	5
Core – III	26PPHCC13	Advanced Electronics	6	25	75	100	5
Core – IV	26PPHCC1P	Practical – I	6	40	60	100	4
Generic Elective - I	26PPHGE11	Crystal growth and Thin film Techniques	6	25	75	100	3
Total			**30**				**22**

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits
Semester – II							
Part – III							
Core – V	26PPHCC21	Mathematical Physics – II	6	25	75	100	5
Core – VI	26PPHCC22	Electromagnetic Theory	6	25	75	100	5
Core – VII	26PPHCC23	Quantum Mechanics – I	6	25	75	100	5
Core – VIII	26PPHCC2P	Practical – II	6	40	60	100	4
Generic Elective - II	26PPHGE21	Instrumentation Methods	6	25	75	100	3
Total			**30**				**22**

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PPHCC11	**MATHEMATICAL PHYSICS - I**	**Core – I**	**6**	**5**	**25**	**75**	**100**

Course Objectives		
Enable the students to enhance problem solving skills and to expertise in mathematical techniques required in physics.		
UNIT	**Contents**	**No. of Hours**
I	**Vectors**: Gradient of a scalar field – line, surface and volume integrals – divergence of a vector function-curl of a vector function and its physical significance – gauss divergence theorem - gauss law in differential form – poisson's Equation – aplace Equation – stokes's theorem – green's theorem – green's theorem in a plane – orthogonal curvilinear coordinates.	18
II	**Matrices**: Review of algebraic operations on matrices – special types of matrices – transpose of a matrix & its properties – the conjugate of a matrix – symmetric & antisymmetric matrices – hermitian & skew hermitian – determinant of a matrix – adjoint of a matrix – inverse of a matrix – orthogonal & unitary transformations – rank of the matrix – eigen values, eigen vectors characteristic equation of a matrix – Cayley-Hamilton theorem.	18
III	**Tensor & Beta Gamma functions**: Tensor: Scalars, contra variant vectors and covariant vectors – tensors of higher rank –algebraic operation of tensors – symmetric and anti-symmetric tensors definitions. Beta Gamma functions: Symmetry property of beta function - evaluation of beta functions- transformation of beta functions - evaluation of gamma functions - transformation of gamma functions - relation between beta and gamma functions - evaluation of miscellaneous integrals - miscellaneous important preposition.	18
IV	**Complex Variable:** Introduction- functions of complex variables – analytic function - Cauchy Riemann differential equation - Cauchy-Riemann in polar form - Laplace's equation: Harmonic functions - line integral of a complex function - Cauchy's integral theorem [elementary proof 1] - Cauchy's Integral formula. Taylor's series - Laurent's series - singularities of an analysis function - residues and their evaluation – Cauchy residue theorem.	18
V	**Group theory**: Concept of a group - abelian group – generators of finite group - cyclic groups group multiplication table - rearrangement theorem – sub groups - cosets - conjugate elements and classes –isomorphism and	18

	homomorphism - group of symmetry of an equilateral triangle - group of symmetry of square – representation of a group – reducible and irreducible representation	
	Total	**90**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Describe the mathematical basic of vectors and their application in physics problems.	K1,K2,K3,K4,K5
2	Explain the concept of vectors and Eigen values and their physical meaning.	K1,K2,K3,K4,K5
3	Explain the beta gamma and special functions.	K1,K2,K3,K4,K5
4	Evaluate the Cauchy residue problems	K1,K2,K3,K4,K5,K6
5	Solve the basic concepts of group theory	K1,K2,K3,K4,K5,K6

K1-Knowledge, K2-Understand, K3-Apply, K4- Analyse, K5- Evaluate, K6 - Creating

Textbooks

1.	Sathya prakash, ***Mathematical Physics***, Sulthan chand & sons, New Delhi, 2006.
2.	B.D. Gupta, ***Mathematical Physics***, Vikas Publishing house pvt Ltd, New Delhi, 4th edition, 2006.

Reference Books

1.	H. K. Dass, ***Mathematical physics***, S CHAND company Ltd, 1st edition, 2010.
2.	A.K. Ghatak, I.C. Goyal & S.J. Chua, ***Mathematical Physics***, Laxmi Publications, 2nd edition, 2019.

e-Resources

1.	https://share.google/MliOmqULGWNM0Qnp0

Mapping with Programme Outcomes:

CO /PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	1	1	2
CO2	3	3	1	3	2
CO3	2	1	2	2	3
CO4	2	1	3	2	2
CO5	3	2	2	3	2

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
	UNIT – I	
1.1	Gradient of a scalar field – line, surface and volume integrals – divergence of a vector function-curl of a vector function and its physical significance.	4
1.2	Gauss divergence theorem - gauss law in differential form	4
1.3	Poisson's equation – Laplace Equation – Stokes's theorem	4
1.4	Green's theorem – Green's theorem in a plane	3
1.5	Orthogonal curvilinear coordinates	3
	UNIT – II	
2.1	Review of algebraic operations on matrices – special types of matrices – Transpose of a matrix & its properties – the conjugate of a matrix	5
2.2	Symmetric & antisymmetric matrices – hermitian & skew hermitian – determinant of a matrix	4
2.3	Adjoint of a matrix – inverse of a matrix – orthogonal & unitary transformations	5
2.4	Rank of the matrix – eigen values, eigen vectors, characteristic equation of a matrix – Cayley-Hamilton theorem.	4
	UNIT – III	
3.1	Scalars, contravariant vectors and covariant vectors – tensors of higher rank	3
3.2	Algebraic operation of tensors – symmetric and anti-symmetric tensors definitions.	4
3.3	Symmetry property of beta function - evaluation of beta functions- transformation of beta functions - evaluation of gamma functions	4
3.4	Transformation of gamma functions - relation between beta and gamma functions	4
3.5	Evaluation of miscellaneous integrals - miscellaneous important preposition.	3
	UNIT – IV	
4.1	Introduction- functions of complex variables – analytic function - Cauchy Riemann differential equation - Cauchy-Riemann in polar form	4
4.2	Laplace's equation: Harmonic functions - line integral of a complex function	3
4.3	Cauchy's integral theorem [elementary proof 1] - Cauchy's Integral formula	4
4.4	Taylor's series - Laurent's series - singularities of an analysis function	4
4.5	Residues and their evaluation – Cauchy residue theorem.	3
	UNIT – V	

5.1	Concept of a group - abelian group – generators of finite group	4
5.2	Cyclic groups group multiplication table - rearrangement theorem	4
5.3	Sub groups - cosets - conjugate elements and classes –isomorphism and homomorphism	4
5.4	Group of symmetry of an equilateral triangle - group of symmetry of square	3
5.5	Representation of a group – reducible and irreducible representation	3
Total		**90**

Course Designer
Name: Ms. R. Yoga
Assistant Professor of Physics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PPHCC12	**CLASSICAL DYNAMICS**	**Core – II**	**6**	**5**	**25**	**75**	**100**

Course Objectives

Enable the students to emphasize the mathematical formulation of mechanics problems and to physically interpret the solution and Gain knowledge on canonical transformation, Poisson and Lagrange brackets.

UNIT	Contents	No. of Hours
I	**Basic concepts:** Basic concepts - coordinate systems – degrees of freedom - constraints -generalised co-ordinates - principle of virtual work - D'Alembert's Principle - Lagrangian equations of motion from D'Alembert's principle - applications - motion under central force - bead sliding on a uniformly rotating wire.	18
II	**Hamiltonian formulation**: Hamiltonian Formulation - Deduction of Hamilton's principle from the D'Alembert's principle – Modified Hamilton's principle - Hamilton's canonical equation of motion from modified Hamilton's principle - Applications - Motion of a particle in a central force field - Charged particle moving in an electromagnetic field - principle of least action-Other forms of principle of least action.	18
III	**Canononical transformation**: Canonical Transformation – Generating Functions – Applications – Poisson's Brackets – Properties of Poisson Bracket – Lagrange Brackets – Relation between Poisson and Lagrange Bracket - Invariance of Poisson Bracket with respect to canonical transformation.	18
IV	**Small oscillations, normal modes**: Small Oscillations and Normal Modes (Coupled Oscillators)- Introduction – Potential Energy and Equilibrium – Two Coupled Oscillators – General Theory of Small Oscillations – Examples of Two Coupled Oscillators – Vibration of a Linear Triatomic Molecule – Transverse Oscillation of N-Coupled Masses on an Elastic String: Many Coupled Oscillators – Transition from Discrete to a Continuous System; Waves on a String.	18
V	**Dynamics of rigid body:** Dynamics of Rigid Body – Euler's angles – Angular momentum and Inertia tensor – Principal axes Transformation – Rotational kinetic energy of a Rigid Body – Eulers Equation of motion of Rigid Body - Torque-free motion of Rigid Body - Geometrical description of the rigid body motion.	18
Total		**90**
Course Outcomes		**Knowledge Level**

CO	On completion of this course, students will	
1	Gain solid foundation in the mechanics of particles and its extension to Lagrangian function	K1,K2,K3,K4,K5
2	Analyse the concept of Hamiltonian equation and its physical significance	K1,K2,K3,K4,K5
3	Apply the concept of canonical transformation and to gain knowledge on lagrange and poison brackets.	K1,K2,K3,K4,K5
4	Explain the Small Oscillation and Normal Modes Coupled Oscillators	K1,K2,K3,K4,K5,K6
5	Evaluate the moment of inertia of rigid bodies	K1,K2,K3,K4,K5,K6
K1-Knowledge, K2-Understand, K3-Apply, K4- Analyse, K5- Evaluate, K6 - Creating		
Textbooks		
1.	J.C. Upadhyaya, ***Classical Mechanics***, Himalaya publishing house, Mumbai, 2005, second edition.	
2.	Gupta Kumar & Sharma, ***Classical Mechanics***, PragatiPrakashan, New Delhi,2003, second edition.	
Reference Books		
1.	A. K. Raychaudri, ***Classical Mechanics***, Oxford University Press, Calcutta, 1st edition, 1983.	
2.	T.G. Takwale & P.S. Purnaik***, Introduction to classical mechanics***, Tata McGraw Hill, New Delhi, 1st edition, 2018.	
e-Resources		
1.	https://ocw.mit.edu/courses/8-01sc-classical-mechanics-fall-2016/	

Mapping with Programme Outcomes:

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	2	3	1	2	1
CO2	2	1	3	2	3
CO3	2	3	2	3	2
CO4	2	1	2	2	3
CO5	1	2	3	3	2

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
UNIT - I		

1.1	Coordinate systems - degrees of freedom	4
1.2	Constraints	4
1.3	Generalised co-ordinates - principle of virtual work	4
1.4	D'Alembert's Principle - Lagrangian equations of motion from D'Alembert's principle	3
1.5	Applications - motion under central force - bead sliding on a uniformly rotating wire.	3
UNIT – II		
2.1	Hamiltonian Formulation	3
2.2	Deduction of Hamilton's principle from the D'Alembert's principle - modified Hamilton's principle	4
2.3	Hamilton's canonical equation of motion from modified Hamilton's principle - application	4
2.4	Motion of a particle in a central force field	3
2.5	Charged particle moving in an electromagnetic field	2
2.6	Principle of least action - other forms of principle of least action	2
UNIT - III		
3.1	Canonical Transformation	4
3.2	Generating Functions - applications	4
3.3	Poisson's Brackets - properties of poisson Bracket	4
3.4	Lagrange brackets - relation between poisson and lagrange bracket	3
3.5	Invariance of poisson bracket with respect to canonical transformation	3
UNIT – IV		
4.1	Introduction, potential energy and equilibrium	3
4.2	Two coupled oscillators	3
4.3	General theory of small oscillations –	3
4.4	Examples of two coupled oscillators	3
4.5	Vibration of a linear triatomic molecule	2
4.6	Transverse oscillation of N-Coupled masses on an elastic string: many coupled oscillators	2
4.7	Transition from discrete to a continuous system; waves on a string.	2
UNIT – V		
5.1	Dynamics of rigid body - euler's anlges	3
5.2	Angular momentum and inertia tensor	3
5.3	Principal axes transformation	3
5.4	Rotational kinetic energy of a rigid body	3
5.5	Eulers equation of motion of rigid body	2
5.6	Torque-free motion of rigid body	2
5.7	Geometrical description of the rigid body motion	2
Total		**90**

Course Designer
Name: MS. K. Roobini
Assistant Professor of Physics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PPHCC13	**ADVANCED ELECTRONICS**	**Core – III**	**6**	**5**	**25**	**75**	**100**

Course Objectives

Make the students to expertise in the advanced electronic devices and circuits including operational amplifier and microprocessors to physically interpret the solution and Gain knowledge on circuit operation, characteristics, waveform generation etc.

UNIT	Contents	No. of Hours
I	**Electronic devices:** **Special Purpose Diodes:** Operation and characteristics and applications of zener diode, varactor, schottky, and tunnel diodes and unn Diode. **FET:** The junction field effect transistor and V-I characteristics, MOSFET and types, output characteristics and applications (switch, amplifier). **Negative Resistance and Devices:** Uni-Junction transistor and its characteristics - UJT relaxation oscillator – UJT applications, characteristics and applications SCR - characteristics and applications.	18
II	**Electronic circuits:** **Non sinusoidal oscillators using transistor:** Saw tooth wave generator and square wave generator, schmitt trigger. **Active filters using RLC:** Types of filters- low pass filter; high pass filter, band pass filter, band stop filters, series inductor filter, shunt capacitor filter, LC filters, Bi filter, twin T notch filters. **Voltage Regulators**: Zener diode regulator, Transistor series voltage regulator, Transistor current regulator.	18
III	**Linear circuits:** **Operational Amplifier:** Operational amplifier symbol, output voltage, ideal Op-amp, band width and slew rate. application of Op-amp: inverting and non-inverting amplifier, integrators and differentiators, comparators, log, antilog amplifiers. OP amp based self-oscillators, phase shift, Wien Bridge. **IC Fabrication Technology:** Integrated circuits an IC package – IC classification – making monolithic IC – fabrication of components on monolithic IC – simple monolithic IC's- some IC construction IC 741 and IC 555.	18
IV	**Digital principles:** **Fundamentals of Digital Electronics**: Binary to decimal, octal to hexa decimal and gray code, basics of logic gates – timing diagrams and their design of practical applications - digital integrated circuits – performance characteristics and parameter of digital IC's 74series - sequential logic **Flip Flops:** SR, JK, Master slave, D and T flip flop – level triggering and	18

	edge triggering **Counters and Shift Registers:** Two, three, four, sixteen bit counters using JK flip flop – asynchronous and synchronous type – decade and modulo n counter – up/down synchronous counter – ring counter – shift registers – serial in – serial out – serial in parallel out – parallel in serial out – parallel in parallel out	
V	**Microprocessors and memories:** **Microprocessor**: Microprocessor architecture, address, data and control buses, addressing modes, memory decoding, microprocessor 8085, **Memories:** Memory Basics – Random Access Memory – Static Ram (SRAMs) – Dynamic RAM (DRAMs) - Read Only Memory – The Mask ROM – Programmable ROM's – The Flash Memory – Basic Flash Memory Operation – Comparison of Flash Memories with other Memories - Memory Expansion – **Special type Of Memories:** FIFO – LIFO – CCD Memories - magnetic and optical Storage – testing memory chips.	18
	Total	**90**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Understand the solid state devices and their characteristics	K1,K2,K3,K4,K5
2	Knowing the Transistor non-sinusoidal waveform generations and types of ac filter using RLC circuits along with power supply design	K1,K2,K3,K4,K5
3	Apply the concept of operational amplifier and to gain knowledge on various circuit construction and acquiring knowledge of IC fabrication methods	K1,K2,K3,K4,K5
4	Expertise in Digital based circuits and shift registers	K1,K2,K3,K4,K5,K6
5	Gain the skill of microprocessor addressing and digital memories	K1,K2,K3,K4,K5,K6
K1-Knowledge, K2-Understand, K3-Apply, K4- Analyse, K5- Evaluate, K6 - Creating		

Textbooks	
1.	B.L. Theraja, ***Basic Electonics***, S.Chand & Co. Ltd., New Delhi, 2nd edition, 2005
2.	S. Salivahanan, Sureshkumar, Vallavaraj, ***Electronic Devices and Circuits***, Tata Mc Graw Hill, 2004.
Reference Books	
1.	V.K. Mehta and Rohit Mehta, ***Principles of Electronics***, S.Chand & Co. Ltd., New Delhi, New Delhi 2016
2	Thomas L. Floyd, ***Digital Fundamentals***, 11th edition, 2015.
3	Malvino, Leech, ***Digital principles and applications***, Tata Mc-Graw Hill, 6th edition, 2014.
e-Resources	
1.	https://nptel.ac.in/course.html/digital circuits/

Mapping with Programme Outcomes:

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	2	1
CO2	3	1	2	3	3
CO3	3	3	3	3	2
CO4	3	2	2	2	2
CO5	2	2	3	3	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
	UNIT - I	
1.1	Operation and characteristics and applications of Zener diode, Varactor, Schottky , and Tunnel diodes and Gunn Diode	5
1.2	The junction field effect transistor and V-I characteristics, MOSFET and types, output characteristics and applications (switch, amplifier)	5
1.3	Uni-Junction transistor and its characteristics - UJT relaxation oscillator – UJT applications	4
1.4	Characteristics and applications SCR - characteristics and applications.	4
	UNIT – II	
2.1	Saw tooth wave generator and Square wave generator, Schmitt Trigger.	4
2.2	Types of Filters- low pass Filter; High pass Filter, Band pass filter, Band Stop Filters.	5
2.3	Series Inductor Filter, Shunt capacitor Filter, LC Filters, Bi filter, Twin T notch filters.	5
2.4	Zener Diode regulator, Transistor series Voltage regulator, Transistor current regulator.	4
	UNIT – III	
3.1	Operational amplifier symbol, output voltage, Ideal Op-amp, band width and slew rate	4
3.2	Application of Op-amp: Inverting and non-inverting amplifier,	4

	Integrators and differentiators, comparators, log, antilog amplifiers.	
3.3	OP amp based self-oscillators, phase shift, Wien Bridge	4
3.4	Integrated circuits an IC package – IC classification – making monolithic IC – Fabrication of components on monolithic IC – simple monolithic IC's-	3
3.5	Some IC construction IC 741 and IC 555.	3
UNIT - IV		
4.1	Binary to decimal, octal to Hexa decimal and Gray code, Basics of Logic gates – Timing diagrams and their design of practical applications	3
4.2	Digital integrated circuits – Performance characteristics and parameter of digital IC's 74series - Sequential logic	3
4.3	SR, JK, Master slave, D and T flip flop – Level triggering and edge triggering	4
4.4	Two, three, four, sixteen bit counters using JK flip flop – Asynchronous and synchronous type – Decade and modulo n counter – UP/DOWN synchronous counter – Ring counter	4
4.5	Shift registers – Serial in – Serial out – Serial in parallel out – Parallel in serial out – Parallel in parallel out	4
UNIT – V		
5.1	Microprocessor Architecture, address, Data and control buses, Addressing modes, memory decoding, microprocessor 8085,	5
5.2	Memory Basics – Random Access Memory – Static Ram (SRAMs) – Dynamic RAM (DRAMs) - Read Only Memory – The Mask ROM – Programmable ROM's	3
5.3	The Flash Memory – Basic Flash Memory Operation – Comparison of Flash Memories with other Memories - Memory Expansion	5
5.4	FIFO – LIFO – CCD Memories - Magnetic and optical Storage – Testing Memory Chips.	5
Total		**90**

Course Designer
Name: Dr. S. Prasanna Subramanian
Assistant Professor of Physics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PPHCC1P	**PRACTICAL – I**	**Core – IV**	**6**	**4**	**40**	**60**	**100**

Course Objectives		
Enable the students to develop practical skills and verify the various basic concepts of Physics in mechanical, optical experiments and electronics.		
UNIT	**Contents**	**No. of Hours**
I	Spectrometer Charge of electron - Inverting and Non-Inverting characteristics of Op-amp - Study of wave shaping circuits using PN diode	18
II	Study of IV characteristics of UJT - Study of regulation characteristics of a Zener diode and design a voltage regulator	18
III	AC and DC load line analysis of a Transistor - Study of IC 74 Series and Design a combined logic equation (A+B) (A+C) =A+BC	18
IV	Study of Thermistor and Thermocouple - RC phase shift oscillator using IC 741 - Study of Class A power amplifier	18
V	Design of Half subtractor and full subtractor digital circuit - Design of Serial in Serial out shift register	18
	Total	**90**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Understand the basic applications of Op-Amp	K1,K2,K3,K4,K5
2	Analyze the characteristics of Transistors	K1,K2,K3,K4,K5
3	Experiments related to heat and light	K1,K2,K3,K4,K5
4	Design the wave shaping using PN diode	K1,K2,K3,K4,K5,K6
5	Analyze the characteristics of zener diode	K1,K2,K3,K4,K5,K6
K1-Knowledge, K2-Understand, K3-Apply, K4- Analyse, K5- Evaluate, K6 - Creating		
Text books		
1.	Samir Kumar Ghosh, ***A Textbook of Advanced Practical Physics***, NCBA Publications, 4th edition, 2008.	
Reference Books		
1.	P.R.Sasikumar, ***Practical Physics***, PHI Learning Private Limited, New Delhi, 2011.	
e-Resources		
1.	https://share.google/5TWw6ILsAP763qLdc	

Mapping with Programme Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	3	3
CO2	3	1	2	2	1
CO3	1	2	2	3	1
CO4	3	3	3	3	3
CO5	2	3	2	2	1

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LAB SCHEDULE

Module No.	Topic	No. of Hours
	UNIT - I	
1.1	Spectrometer Charge of electron	9
1.2	Inverting and Non-Inverting characteristics of Op-amp **-**	9
	UNIT – II	
2.1	Study of IV characteristics of UJT	9
2.2	Study of regulation characteristics of a Zener diode and design a voltage regulator.	9
	UNIT – III	
3.1	AC and DC load line analysis of a Transistor	9
3.2	Study of IC 74 Series and Design a combined logic equation (A+B) (A+C) =A+BC	9
	UNIT – IV	
4.1	Study of Thermistor and Thermocouple	6
4.2	RC phase shift oscillator using IC 741	6
4.3	Study of Class A power amplifier	6
	UNIT - V	
5.1	Design of Half subtractor and full subtractor digital circuit -	9
5.2	Design of Serial in Serial out shift register	9
	Total	**90**

Course Designer
Name: Ms. R. Yoga
Assistant Professor of Physics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PPHGE11	**CRYSTAL GROWTH AND THIN FILM TECHNIQUES**	**Generic Elective – I**	**6**	**3**	**25**	**75**	**100**

Course Objectives

Enable the students to understand the theories involves in crystal growth nucleation process and solution, melt and vapour growth techniques and Characterization tools and theoretical concepts involved in crystal growth and thin film sciences.

UNIT	Contents	No. of Hours
I	**Crystal growth Phenomena:** Introduction – nucleation – energy forming of nuclei – spherical and cylindrical nuclei – Gibbs Thomson equation – solvents – solution – solubility – super solubility – expression for super saturation – growth mechanism and classification – solution growth – low and high temperature solution growth – slow cooling – solvent evaporation method – temperature gradient method.	18
II	**Various growth Techniques:** Principle of gel technique – various types of gel – structure and importance of gel – methods of gel growth and advantages – hydrothermal growth – melt technique – Czochralaski growth – Bridgeman method – flux growth.	18
III	**Thin film Phenomena:** Introduction- nature of thin film- deposition technology- thermal deposition in vacco- kinetic energy if gas and emission condition – distribution of deposit - resistance heating- thermal evaporation- flash evaporation - flash evaporation – multi evaporation process – R.f or inducting Heating – cathodic sputtering- glow discharge sputtering – low pressure sputtering – reactive sputtering	18
IV	**Film growth Techniques:** Chemical vapour deposition or vapour plating – thermal decomposition or p- Vapour phase reaction – disproportional method – chemical deposition – electrode position – anodic oxidation – electroless plating – deposition by chemical reaction – chemical displacement - film thickness and its control – mass method – optical method – other methods- rate meter or monitor– substrate cleaning.	18
V	**Nucleation, Film growth Structure:** Nucleation – thermodynamics of nucleation – nucleation theories – capillary model-atomistic or statistical model – effect of super saturation , temperature, lattice strain, impurity, surface imperfection – comparison of the two models of nucleation – film growth – incorporation of defects, impurities in film – deposition parameters and grain size – epitaxy.	18

	Total	90
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Understand the nucleation mechanisms and the various factors of nucleation for crystal growth	K1,K2,K3,K4,K5
2	Acquire the knowledge on the concepts of various growth techniques	K1,K2,K3,K4,K5
3	Understand the introduction about the Thin Films.	K1,K2,K3,K4,K5
4	Understand the different thin film deposition techniques.	K1,K2,K3,K4,K5,K6
5	To familiarize with physics and techniques involved in the measurement and characterization of thin films.	K1,K2,K3,K4,K5,K6
K1-Knowledge, K2-Understand, K3-Apply, K4- Analyse, K5- Evaluate, K6 - Creating		
Textbooks		
1.	***Crystal Growth Process and Methods***, P. Santhanaragavan& P. Ramasamy, KRU Publications, Kumbakonam, 2001.	
2.	***Jh Thin Film Fundamentals***, A.Gowsami, New Age International Publisers, 2006	
Reference Books		
1.	Introduction to Crystal Growth Principle and Practice H. L Bhat, 2016.	
2.	M. Ohring, ***Materials Science of Thin Films***, Academic Press, Boston, 2nd edition, 2002.	

Mapping with Programme Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	1	2	2	3
CO2	3	2	1	2	2
CO3	3	3	3	2	1
CO4	1	3	3	3	3
CO5	2	2	1	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
UNIT – I		
1.1	Introduction – nucleation- energy forming of nuclei spherical and cylindrical nuclei- Gibbs Thomson equation	4

1.2	Solvents , solution, solubility , super solubility - expression for super saturation	4
1.3	Growth mechanism and classification - solution growth ,	4
1.4	Low and high temperature solution growth - slow cooling	3
1.5	Solvent evaporation method - temperature gradient method	3
UNIT – II		
2.1	Principle of gel technique -various types of gel	5
2.2	Structure and importance of gel- methods of gel growth and advantages	4
2.3	Hydrothermal growth - melt technique	5
2.4	Czochralaski growth - Bridgeman method - flux growth	4
UNIT – III		
3.1	Introduction- nature of thin film- deposition technology- thermal deposition in Vacco	3
3.2	Kinetic energy if gas and emission condition – distribution of deposit - resistance heating	4
3.3	Thermal evaporation- flash evaporation- flash evaporation – multi evaporation process	3
3.4	R.f or inducting Heating – cathodic sputtering	5
3.5	Glow discharge sputtering – low pressure sputtering – reactive sputtering	3
UNIT – IV		
4.1	Chemical vapour deposition or vapour plating - thermal decomposition or pyrolysis	4
4.2	Vapour phase reaction - disproportional method - chemical deposition -electrode position	4
4.3	Anodic oxidation – Electroless plating - deposition by chemical reaction, chemical displacement	4
4.4	Film thickness and its control - mass method -optical method	3
4.5	Other methods- rate meter or monitor- substrate cleaning	3
UNIT – V		
5.1	Nucleation- thermodynamics of nucleation.	4
5.2	Nucleation theories ,capillary model-atomistic or statistical model - effect of super saturation , Temperature, Lattice strain, Impurity, Surface imperfection	4
5.3	Comparison of the two models of nucleation - film growth	4
5.4	Incorporation of defects- impurities in film	3
5.5	Deposition parameters and grain size - epitaxy	3
Total		**90**

Course Designer
Name: Ms. K. Suba
Assistant Professor of Physics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PPHCC21	**MATHEMATICAL PHYSICS – II**	**Core – V**	**6**	**5**	**25**	**75**	**100**

Course Objectives		
The course enables the students to gain knowledge about the mathematical physics and advanced mathematical methods in physics. It also enables the students to use mathematical concepts required in physics and enhances problem solving skills. It imparts mathematical knowledge for the description of physics phenomena.		
UNIT	**Contents**	**No. of Hours**
I	**Differential Equation:** Order and degree of a differential equation – solution of first order differential equation by the method of separation of variables – solution of second order differential equations – singular points of differential equation – Legendre differential equation and Legendre function – generating Function of Legendre Polynomial – Rodrigues's formula for Legendre Polynomial	18
II	**Special Function:** Bessel's Function: recurrence formulae for Jn(x) - generating function for Jn(x), Hermite differential equation Hermite's polynomials – generating function of Hermite polynomials recurrence formulae for Hermite polynomials - Rodrigue's formula for Hermite polynomials – orthogonality of Hermite polynomials.	18
III	**Fourier's and Laplace transforms:** Fourier's Transform –properties of Fourier's transform - Fourier's Transform of a derivative - Fourier's sine and cosine transform of derivatives – finite Fourier transform. Laplace Transform - properties of Laplace transform - Laplace transform of the derivative of a function – Laplace transform of integral – inverse Laplace transform.	18
IV	**Partial Differential Equations:** Partial differential equations in physics – solution of partial differential equations by the method of separation of two variables – solution of Laplace equation in Cartesian coordinates – Fourier equation of heat flow – solution of heat flow.	18
V	**Probability & Numerical Methods:** Introduction - definition of probability-mutually exclusive events – theorem of total probability – compound Events - binomial distribution - the poisson distribution - normal or gaussian distribution Numerical Methods: Introduction- finite Differences-numerical differentiation – numerical integration – solution of ordinary differential equation of first order.	18

	Total	**90**
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Instruct about basic properties of differential equation	K1,K2,K3,K4,K5
2	Inculcate about basic properties of usage of special functions in physics	K1,K2,K3,K4,K5
3	Develop knowledge on the Fourier's and Laplace Transform	K1,K2,K3,K4,K5
4	Describe the properties and Partial Differential Equations in physics	K1,K2,K3,K4,K5,K6
5	Recognize to apply the mathematical concepts in Probability and Numerical methods	K1,K2,K3,K4,K5,K6
K1-Knowledge, K2-Understand, K3-Apply, K4- Analyse, K5- Evaluate, K6 - Creating		
Textbooks		
1.	Sathyaprakash, ***Mathematical Physics***, Sulthan chand & sons, New Delhi, 2006.	
2.	B.D. Gupta, ***Mathematical Physics***, Vikas Publishing house pvt Ltd, New Delhi ,4th edition, 2006.	
Reference Books		
1.	H. K. Dass, ***Mathematical physics***, S CHAND company Ltd, 1st edition, 2010.	
2.	A.K. Ghatak, I.C. Goyal & S.J. Chua***, Mathematical Physics***, Laxmi Publications, 2nd edition, 2019.	
e-Resources		
1.	https://msashigri.wordpress.com/wp-content/uploads/2016/11/methods-of-mathemacial-for-physicists.pdf	

Mapping with Programme Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	1	2	2	3
CO2	2	3	1	2	3
CO3	2	2	3	2	1
CO4	3	3	3	1	3
CO5	3	2	1	3	1

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures

UNIT - I		
1.1	Order and degree of a differential equation – solution of first order differential equation by the method of separation of variables —–	5
1.2	Solution of second order differential equations – singular points of differential equation	5
1.3	Legendre differential equation and Legendre function – generating function of Legendre Polynomial	5
1.4	Rodrigue's formula for Legendre polynomial	3
UNIT – II		
2.1	Bessel's Function: recurrence formulae for Jn(x) - generating function for Jn(x)	5
2.2	Hermite differential equation Hermite's polynomials – generating function of Hermite polynomials	5
2.3	Recurrence formulae for Hermite polynomials - Rodrigue's formula for Hermite polynomials	5
2.4	Orthogonality of Hermite polynomials	3
UNIT – III		
3.1	Fourier's transform – Properties of Fourier's transform	3
3.2	Fourier's transform of a derivative - Fourier's sine and cosine transform of derivatives	4
3.3	Finite Fourier transform	3
3.4	Laplace transform - properties of Laplace transform - Laplace transform of the derivative of a function	4
3.5	Laplace transform of integral – inverse Laplace transform.	4
UNIT – IV		
4.1	Partial differential equations in physics	5
4.2	Solution of partial differential equations by the method of separation of two variables	5
4.3	Solution of Laplace equation in cartesian coordinates	4
4.4	Fourier equation of heat flow – solution of heat flow.	4
UNIT – V		
5.1	Introduction - definition of probability-mutually exclusive events	4
5.2	Theorem of total probability – compound events	4
5.3	Binomial distribution - the poisson distribution - normal or gaussian distribution	4
5.4	Numerical methods i- finite differences- numerical differentiation	3
5.5	Numerical integration – solution of ordinary differential equation of first order	3
Total		**90**

Course Designer
Name: Ms. R. Yoga
Assistant Professor of Physics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PPHCC22	**ELECTROMAGNETIC THEORY**	**Core-VI**	**6**	**5**	**25**	**75**	**100**

Course Objectives		
Enable the knowledge of Electro and magneto statics as well as acquire knowledge of Maxwell equations and Electromagnetic principles		
UNIT	**Contents**	**No. of Hours**
I	**Electrostatics:** Electric charge – electric charge density - Coulomb's law – electric intensity -electric field – electrostatic potential - electric dipole, gauss law and its applications, boundary value problem in electrostatics. poisson's equation – laplace's equation: properties of solutions – solutions to laplace's equation in spherical coordinates – electrostatic images – point charge and conducting sphere – line charges and line images.	18
II	**Magnetostatics:** Ampere's circuital law - magnetic scalar potential – magnetic vector potential – magnetization and magnetization current – magnetic intensity – magnetic susceptibility – magnetic vector potential – the magnetic field of a distant circuit – magnetic scalar potential – magnetic flux – magnetic susceptibility.	18
III	**Magnetic laws and Maxwell's equations:** Biot – Savart Law – elementary applications of Biot – Savart law – Ampere's circuital law - equation of continuity – displacement current - Maxwell's equation – derivations – energy in electromagnetic fields - (poynting's theorem). Maxwell's equation in terms of electromagnetic potentials – concept of gauge-Lorentz gauge.	18
IV	**Electromagnetic waves:** Electromagnetic waves in free space, isotropic dielectrics and conducting media. boundary conditions: reflection and transmission – reflection and transmission of electromagnetic waves at normal and oblique incidence – guided waves: waveguides – TE waves in a rectangular waveguide.	18
V	**Gauges and potentials**: Gauge transformations – Coulomb gauge and Lorentz gauge – retarded potentials – the Lienard – Wiechert potentials – the fields of a moving point charge – electric dipole radiation – magnetic dipole radiation – radiation from an arbitrary source.	18
Total		**90**
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	

1	Understand the electrostatics concepts	K1,K2,K3,K4,K5
2	Expertise the magneto statics	K1,K2,K3,K4,K5
3	Understand all the Maxwell equations	K1,K2,K3,K4,K5
4	Expertise in the field of Electromagnetic waves	K1,K2,K3,K4,K5,K6
5	Gain the skill of potential functions and gauge factor	K1,K2,K3,K4,K5,K6
K1-Knowledge, K2-Understand, K3-Apply, K4- Analyse, K5- Evaluate, K6 - Creating		
Textbooks		
1.	D.J. Griffiths, ***Introduction to Electrodynamics***, PHI, New Delhi, 3rd edition, 2005.	
2.	Rietz, Millford and Christy, ***Foundations of Electromagnetic Theory***, Narosa Publishing House, New Delhi. 1986.	
Reference Books		
1.	Karus and Fleish, ***Electromagnetics with Applications***, Mc Graw Hill, New York, 1999.	
2.	B. Chakaraborthy, ***Principles of Electrodynamics***, Books and Allied, 2002.	
3.	A Zingwell, ***Modern Electrodynamics***, Cambridge University Press, USA Mc-Graw Hill, 2013.	
e-Resources		
1.	http://www.plasma.uu.se/CED/Book/index.html	

Mapping with Programme Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	2
CO2	3	3	3	3	2
CO3	2	3	2	3	3
CO4	3	2	2	2	2
CO5	2	2	3	3	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
UNIT – I		
1.1	Electric charge – electric charge density - Coulomb's law – electric intensity -electric field – electrostatic potential - electric dipole,	6

	gauss law and its applications, boundary value problem in electrostatics.	
1.2	Poisson's equation – Laplace's equation: properties of solutions – solutions to Laplace's equation in spherical coordinates	6
1.3	Electrostatic images – point charge and conducting sphere – line charges and line images.	6
UNIT – II		
2.1	Ampere's circuital law - magnetic scalar potential – magnetic vector potential – magnetization and magnetization current	6
2.2	Magnetic intensity – magnetic susceptibility – magnetic vector potential	6
2.3	The magnetic field of a distant circuit – magnetic scalar potential – magnetic flux – magnetic susceptibility	6
UNIT – III		
3.1	Biot – Savart Law – elementary applications of Biot – Savart law – Ampere's circuital law - equation of continuity – displacement current	6
3.2	Maxwell's equation – derivations – energy in electromagnetic fields - (poynting's theorem)	6
3.3	Maxwell's equation in terms of electromagnetic potentials – concept of gauge-Lorentz gauge.	6
UNIT – IV		
4.1	Electromagnetic waves in free space, isotropic dielectrics and conducting media. boundary conditions: reflection and transmission	6
4.2	Reflection and transmission of electromagnetic waves at normal and oblique incidence	6
4.3	Guided waves: waveguides – TE waves in a rectangular waveguide	6
UNIT – V		
5.1	Gauge transformations – Coulomb gauge and Lorentz gauge	6
5.2	Retarded potentials – the Lienard – Wiechert potentials – the fields of a moving point charge	6
5.3	Electric dipole radiation – magnetic dipole radiation – radiation from an arbitrary source	6
Total		**90**

Course Designer
Name: Dr. S. Prasanna Subramanian
Assistant Professor of Physics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PPHCC23	**QUANTUM MECHANICS – I**	**Core – VII**	**6**	**5**	**25**	**75**	**100**

Course Objectives

The course enables the students to gain deep knowledge on the basics of quantum mechanics from Schrodinger's theory and Heisenberg principles. It deals with solvable systems and methods for some systems like particle in a box. It also enables the particle interaction, rotation features and trajectory properties.

UNIT	Contents	No. of Hours
I	**Origin of the Quantum theory:** Limitation of classical physics - Planck's quantum Hypothesis - Einstein's theory of photoelectric Effect - Compton Effect - quantum theory of specific heat - Bohr model of hydrogen atom - existence of stationary states - elliptic orbits of hydrogen atom - the harmonic oscillator - The rigid rotator-particle in a box - inadequacy of quantum theory.	18
II	**Wave mechanical concept:** Wave nature of particles - the uncertainty principle - the principle of superposition - wave packet - time dependent Schrodinger equation - interpretation of the wave function - Ehrenfest's theorem - time independent Schrodinger equation - stationary states – admissibility condition on the wave function.	18
III	**General formalism of Quantum mechanics:** Linear vector space - linear operator - eigen function and eigen values - Hermitian operator - postulates of quantum mechanics - simultaneous measurability of observable - general uncertainty relation - Dirac's equation - equation of motion - momentum representation.	18
IV	**1 Denergy eigen values:** Square well potential with rigid walls and finite walls – square potential barrier - alpha emission - Bloch waves in a periodic potential - linear harmonic oscillator : Schrodinger method and operator method - free particle in one dimensional energy eigen value Problem**.**	18
V	**3 Denergy eigen values:** Particle moving in a spherical symmetric potential - system of two interaction particle - Rigid rotator - three dimensional square well potential - the deuteron – hydrogenic orbits.	18
	Total	**90**

Course Outcomes		Knowledge Level
CO	**On completion of this course, students will**	
1	Compare classical mechanics and Quantum mechanics,	K1,K2,K3,K4,K5

	Basic concepts of wave function	
2	Understand the Uncertainty, Expectation values, and Ehrenfest's theorem, Schrodinger equation and concept of wave function.	K1,K2,K3,K4,K5
3	Comprehend about the Observables and various operators (Hermitian, Dirac function, Eigen function)	K1,K2,K3,K4,K5
4	Learn about square well potential and linear Harmonic oscillator (Schrodinger and linear operator methods).	K1,K2,K3,K4,K5,K6
5	Elaborate interaction between the particles, spin properties and quantum analysis of particles (deuteron).	K1,K2,K3,K4,K5,K6
K1-Knowledge, K2-Understand, K3-Apply, K4- Analyse, K5- Evaluate, K6 - Creating		
Textbooks		
1.	G. Aruldas , ***Quantum mechanics***, PHI learning private Limited, New Delhi, 2013.	
Reference Books		
1.	R.K. Prasad, ***Quantum Chemistry***, New Agers International Publishers, NewDelhi, 1997.	
2.	P.M. Mathews, K. Venkatesan, ***Quantum mechanics***, Tata McGraw Hill, Noida, 2015.	

Mapping with Programme Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	3	2
CO2	3	2	3	2	2
CO3	2	1	2	1	1
CO4	3	2	3	3	2
CO5	2	2	2	2	2

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
UNIT - I		
1.1	Limitation of classical physics and Planck's quantum hypothesis	2

1.2	Einstein's theory of photoelectric Effect - Compton Effect and quantum theory of specific heat	3
1.3	Bohr model of hydrogen atom - existence of stationary states	3
1.4	Elliptic orbits of hydrogen atom	2
1.5	The harmonic oscillator	3
1.6	The rigid rotator- particle in a box	3
1.7	Inadequacy of quantum theory	2
UNIT – II		
2.1	Wave nature of particles	2
2.2	The uncertainty principle -the principle of superposition - wave packet	3
2.3	Time dependent Schrodinger equation	3
2.4	Interpretation of the wave function - Ehrenfest's theorem	4
2.6	Time independent Schrodinger equation	3
2.7	Stationary states and admissibility condition on the wave function	3
UNIT – III		
3.1	Linear vector space	3
3.2	Linear operator - eigen function and eigen values	3
3.3	Hermitian operator and postulates of quantum mechanics	3
3.4	Simultaneous measurability of observable	3
3.5	General uncertainty relation - Dirac's equation.	3
3.6	Equation of motion and - momentum Representation	3
UNIT – IV		
4.1	Square well potential with rigid walls and finite walls	5
4.2	Square potential Barrier - alpha emission and Bloch waves in a periodic potential	5
4.3	Linear harmonic oscillator - Schrodinger method and operator method	5
4.4	Free particle in one dimensional energy eigen value problem	3
UNIT – V		
5.1	Particle moving in a spherical symmetric potential	5
5.2	System of two interaction particle-rigid rotator	5
5.3	Three dimensional square well potential	5
5.4	The deuteron and hydrogenic orbits	3
Total		**90**

Course Designer
Name: Ms. K. Suba
Assistant Professor of Physics.

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PPHCC2P	**PRACTICAL – II**	**Core – VIII**	**6**	**4**	**40**	**60**	**100**

Course Objectives		
Enable the students to develop practical skills and verify the various basic concepts of Physics in mechanical, optical experiments and electronics.		
UNIT	**Contents**	**No. of Hours**
I	Finding of Fraunhofer spectral lines using solar spectrum **-** Study of Inverting, Non-Inverting amplifier, voltage follower using DC power supply and Op. Amp	18
II	Amplification characteristics of Op-amp using AC source (Inverting and Non-Inverting) **-** Square wave generator using IC 741 **-** Design of Serial in Parallel out shift register	18
III	Design a circuit for Sum of Product and Product of sum using Digital ICs **-**Demorgan's laws verification for three inputs and Boolean law verification (AND, OR and NOT) for three input	18
IV	UJT Relaxation oscillator **-** IV characterstics of SCR - Designing of a power supply to study repulsion characteristics with C, L and CLC filters	18
V	Photodiode and Phototransistor – Characteristics - Operational Amplifier - Integrator of Differentiator	18
TOTAL		**90**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Understand the basic applications of solar spectrum	K1,K2,K3,K4,K5
2	Analyze the characteristics of Op-amp (Inverting and Non-Inverting)	K1,K2,K3,K4,K5
3	Demonstration of sum using Digital ICs	K1,K2,K3,K4,K5
4	Design the UJT Relaxation oscillator	K1,K2,K3,K4,K5,K6
5	Analyze the characteristics C, L and CLC filters.	K1,K2,K3,K4,K5,K6

K1-Knowledge, K2-Understand, K3-Apply, K4- Analyse, K5- Evaluate, K6 - Creating

Textbooks

1. Samir Kumar Ghosh, ***A Text book of Advanced Practical Physics***, NCBA Publications, 4th edition, 2008.

Reference Books

1. P.R.Sasikumar, ***Practical Physics***, PHI Learning Private Limited, New Delhi, 2011.

e-Resources

1. https://share.google/5TWw6ILsAP763qLdc

Mapping with Programme Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	3	2
CO2	3	2	3	2	2
CO3	1	1	1	1	1
CO4	3	2	3	3	3
CO5	2	2	2	2	2

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LAB SCHEDULE

Module No.	Topic	No. of Hours
	UNIT - I	
1.1	Finding of Fraunhofer spectral lines using solar spectrum	9
1.2	Study of Inverting, Non-Inverting amplifier, voltage follower using DC power supply and Op. Amp	9
	UNIT – II	
2.1	Amplification characteristics of Op-amp using AC source (Inverting and Non-Inverting)	6
2.2	Square wave generator using IC 741	6
2.3	Design of Serial in Parallel out shift register	6
	UNIT – III	
3.1	Design a circuit for Sum of Product and Product of sum using Digital ICs	9
3.2	Demorgan's laws verification for three inputs and Boolean law verification (AND, OR and NOT) for three input	9
	UNIT – IV	
4.1	UJT Relaxation oscillator	6
4.2	IV characterstics of SCR	6
4.3	Designing of a power supply to study repulsion characteristics with C, L and CLC filters	6
	UNIT - V	
5.1	Photodiode and Phototransistor – Characteristics	9
5.2	Operational Amplifier - Integrator of Differentiator	9
	Total	**90**

Course Designer

Name: Ms. R. Yoga

Assistant Professor of Physics

Course Code	Course Title	Category	Hours	Credits	Marks		
					CIAE	TEE	Total
26PPHGE21	**INSTRUMENTATION METHODS**	**Generic Elective - II**	**6**	**3**	**25**	**75**	**100**

Course Objectives		
Students will able to understand the fundamental principles of various instrumental methods and identify the applications and limitations of each technique.		
UNIT	**Contents**	**No. of Hours**
I	**Thermo analytical instrumentation:** Thermo analytical methods – Thermo Gravimetric Analysis (TGA) – instrumentation – determination of weight loss and decomposition of products - Differential Thermal Analysis (DTA) – instrumentation - Simultaneous Thermo Gravimetry/Differential Thermal Analysis (TG/DTA) – Thermomechanical Analysis – Differential Scanning Calorimetry (DSC).	18
II	**Microscope techniques:** Scanning Electron Microscope (SEM) – Scanning Transmission Electron Microscope (STEM) – Scanning Probe Microscope (SPM) - Scanning Tunneling Microscope (STM) – Atomic Force Microscope (AFM) – instrumentation, principle, data collection and analysis	18
III	**UV-Vis and spectrometers:** Principles and instrumentation for UV-Vis – IR – FTIR – spectroscopy – Raman spectroscopy – surface spectroscopic technique - NMR – ESR – Electron spectroscopy – X-ray spectrum – instrumentation of X-ray spectrometry – X-ray diffractometer – diffraction and Bragg's law – X-ray absorption meter	18
IV	**Chromatography and PH meters:** Chromatography- basic parts of chromatography- methods of measurement – liquid chromatography – types- amino acid analyzer- gas Chromatography - electrochemical cell- types of electrodes- conductivity meter- polorography- coulometers- amperometers- aqua meter- PH measurement- principle- PH meters- selective ion electrodes.	18
V	**Computer analytical instruments:** Computer in analytical laboratories – digital computer – types – modems – computer software – interconnecting laboratory instruments to computers – computer networks – laboratory information management system – smart laboratory.	18
Total		**90**

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Discuss various Instrumental methods and techniques.	K1,K2,K3,K4,K5

2	Describe advanced spectroscopic techniques.	K1,K2,K3,K4,K5
3	Analyze the different systems for qualitative determination of elements.	K1,K2,K3,K4,K5
4	Apply various analytical methods for analyzing elements.	K1,K2,K3,K4, K5,K6
5	Use numerous electrical devices to analyze organic compounds.	K1,K2,K3,K4, K5,K6
K1-Knowledge, K2-Understand, K3-Apply, K4- Analyse, K5- Evaluate, K6 - Creating		
Textbooks		
1.	R.S. Khandpur, ***Hand book of analytical instrumentation***, Tata McGraw Hill Pvt Ltd., New Delhi, 3rd edition, (2001).	
2.	H.H. Willard, L.L. Merit, J.A. Dean, F.A. Settle, ***Instrumental Methods of Analysis***, CBS Publishers and Distributors, New Delhi, 1986.	
Reference Books		
1.	G.Chatwal, S.Anand, ***Instrumental Methods of Chemical Analysis***, Himalaya Publications House, New Delhi, 1996.	
2.	Robert, D. Braun, ***Introduction to Instrumental analysis***, McGraw Hill Book House, New Delhi, 1986.	

Mapping with Programme Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	3	2
CO 2	2	3	2	2	3
CO 3	1	2	1	1	1
CO 4	2	1	2	3	3
CO 5	2	2	3	2	2

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

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

Strong-3 Medium-2 Low-1

COURSE CONTENTS AND LECTURE SCHEDULE

Module No.	Topic	No. of Lectures
UNIT - I		
1.1	Thermo analytical methods – Thermo Gravimetric Analysis(TGA) – instrumentstion	4
1.2	determination of weight loss and decomposition of products	4
1.3	Differential Thermal Analysis(DTA) – instrumentation - simultaneous thermo gravimetry)	4

1.4	Differential thermal analysis - thermomechanical analysis	3
1.5	Differential Scanning Calorimetry (DSC)	3
UNIT – II		
2.1	Scanning Electron Microscope (SEM)	3
2.2	Scanning Transmission Electron Microscope (STEM)	3
2.3	Scanning Probe Microscope (SPM) -	4
2.4	Scanning Tunneling Microscope (STM)	3
2.5	Atomic Force Microscope (AFM)	2
2.6	Instrumentation, principle, data collection and analysis	3
UNIT – III		
3.1	Principles and instrumentation for UV-Vis – IR	3
3.2	FTIR – spectroscopy – Raman spectroscopy	4
3.3	Surface spectroscopic technique - NMR – ESR – Electron spectroscopy	4
3.4	X-ray diffractometer – diffraction and Bragg's law	4
3.5	X-ray absorption meter	3
UNIT – IV		
4.1	Chromatography- basic parts of chromatography- methods of measurement	4
4.2	Liquid chromatography – types- amino acid analyzer- gas chromatography	3
4.3	Electrochemical cell- types of electrodes- conductivity meter- polorography	4
4.4	Coulometers- amperometers- aqua meter	4
4.5	PH measurement- principle- PH meters- selective ion electrodes.	3
UNIT – V		
5.1	Computer in analytical laboratories – digital computer	4
5.2	Types – modems	3
5.3	Computer software – interconnecting laboratory instruments to computers	4
5.4	Computer networks – laboratory information management system	4
5.5	Smart laboratory.	3
Total		**90**

Course Designer
Name: Ms. K. Roobini
Assistant Professor of Physics