SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

SCHOOL OF ARTS AND SCIENCE

MASTER OF SCIENCE
IN
PHYSICS

(R-2023)
CURRICULUM AND SYLLABI

STRUCTURE FOR POST GRADUATE PROGRAMME

Sl.No	Course Category	Total Credits
1	Discipline Specific Core Courses (DSC)	64
2	Discipline Specific Elective Courses (DSE)	16
3	Skill Enhancement Courses (SEC)	08
Total		**88**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl.No	Course Category	Credits per Semester				Total Credits
		I	II	III	IV	
1	Discipline Specific Core Courses (DSC)	16	16	16	16	64
2	Discipline Specific Elective Courses (DSE)	4	4	4	4	16
3	Skill Enhancement Courses (SEC)	2	2	2	2	08
Total		**22**	**22**	**22**	**22**	**88**

**** EEC will not be included for the computation of "total of credits" as well as "CGPA"***

SEMESTER – I											
Sl. No.	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	A23PPHT101	Classical Mechanics	**DSC**	4	0	0	4	25	75	100
2	A23PPHT102	Mathematical Physics I	**DSC**	4	0	0	4	25	75	100
3	A23PPHT103	Electromagnetic Theory	**DSC**	4	0	0	4	25	75	100
4	A23PPHE10X	Discipline Specific Elective I*	**DSE**	4	0	0	4	25	75	100
Practical										
5	A23PPHL101	General Practical-I	**DSC**	0	0	4	2	50	50	100
6	A23PPHL102	Electronics Practical-I	**DSC**	0	0	4	2	50	50	100
Skill Enhancement Course										
7	A23PPHS101	Professional Skills	**SEC**	2	0	0	2	100	0	100
			First Semester Total				22	300	400	700

Discipline Specific Electives are to be selected from the list given in Annexure I

SEMESTER – II										
Sl. No.	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	A23PPHT204	Statistical Mechanics	**DSC**	4	0	0	4	25	75	100
2	A23PPHT205	Mathematical Physics II	**DSC**	4	0	0	4	25	75	100
3	A23PPHT206	Quantum Mechanics-I	**DSC**	4	0	0	4	25	75	100
4	A23PPHE20X	Discipline Specific Elective II	**DSE**	4	0	0	4	25	75	100
Practical										
5	A23PPHL203	General Practical-II	**DSC**	0	0	4	2	50	50	100
6	A23PPHL204	Electronics Practical-II	**DSC**	0	0	4	2	50	50	100
Skill Enhancement Course										
7	A23PMAS201	Quantitative Reasoning and Research Aptitude	SEC	2	0	0	2	100	0	100
			Second Semester Total				22	300	400	700

Discipline Specific Electives are to be selected from the list given in Annexure I

SEMESTER – III										
Sl. No.	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	A23PPHT307	Molecular Physics	**DSC**	4	0	0	4	25	75	100
2	A23PPHT308	Quantum Mechanics - II	**DSC**	4	0	0	4	25	75	100
3	A23PPHT309	Condensed Matter Physics	**DSC**	4	0	0	4	25	75	100
4	A23PPHE30X	Discipline Specific Elective II	**DSE**	4	0	0	4	25	75	100
Practical										
5	A23PPHL306	Microprocessor Practical-I	**DSC**	0	0	4	2	50	50	100
Skill Enhancement Course										
6	A23PPHS302	Advance Research Methodology in Physics	SEC	2	0	0	2	100	0	100
Internship										
7	A23PPHN301	Internship / In-plant training	**DSC**	0	0	4	2	40	60	100
			Third Semester Total				22	340	460	800

Discipline Specific Electives are to be selected from the list given in Annexure I

SEMESTER – IV										
Sl. No.	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	A23PPHT410	Nuclear & Particle Physics	**DSC**	4	0	0	4	25	75	100
2	A23PPHT411	Materials Science	**DSC**	4	0	0	4	25	75	100
3	A23PPHE40X	Discipline Specific Elective II	**DSE**	4	0	0	4	25	75	100
Practical										
4	A23PPHL407	Microprocessor Practical-II	**DSC**	0	0	4	2	50	50	100
Project										
5	A23PPHP401	Project Work and Dissertation	**DSC**	0	0	12	6	40	60	100
Skill Enhancement Course										
6	A23PPHS403	Non-Destructive Testing	SEC	2	0	0	2	100	0	100
			Fourth Semester Total				22	265	335	600

Discipline Specific Electives are to be selected from the list given in Annexure I

Annexure – I
DISCIPLINE SPECIFIC ELECTIVE COURSES**

Discipline Specific Elective – I (Offered in Semester I)		
Sl. No.	**Course Code**	**Course Title**
1	A23PPHE101	Digital Electronics Principles
2	A23PPHE102	Instrumentation
3	A23PPHE103	Physics of Nano materials
Discipline Specific Elective – II (Offered in Semester II)		
1	A23PPHE204	Atmospheric Physics
2	A23PPHE205	Nonlinear Optics
3	A23PPHE206	Microprocessor and Microcontroller
Discipline Specific Elective – III (Offered in Semester III)		
1	A23PPHE307	Communication Electronics
2	A23PPHE308	Molecular Physics
3	A23PPHE309	Biomedical Instrumentation
Discipline Specific Elective – IV (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	A23PPHE410	Research Methodology, Computation Methods & Programming
2	A23PPHE411	Astronomy & Astrophysics
3	A23PPHE412	Non-Destructive Testing

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	I	Course Category Code: DSC				End Semester Exam Type: **TE**		
Course Code	**A23PPHT101**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**CLASSICAL MECHANICS**	**4**	**0**	**0**	**4**	**25**	**75**	**100**
Prerequisite	comfortable with Newton's laws and with basic physics concepts such as mass, moments of inertia, length, force and time							
Course Objectives	To know the classical mechanical methods and theories.							
	To get knowledge in central force field motion							
	To solve the Equation of Canonical Transformations							
	To understand the small oscillations of molecules.							
	To solve the equation of motion using Lagrangian, Hamilton and Hamilton Jacobi equations							

Course Outcomes	***On completion of the course, the students will be able to***	BT Mapping (Highest Level)
	CO1 Learn about the dynamics of system of particles using Hamiltonian, Lagrangian and Jacobi.	**K3**
	CO2 Understand the planetary motion using Kepler's law	**K3**
	CO3 Develop the equation of canonical Transformations	**K3**
	CO4 Solve small oscillations using Legendre transformations and Hamiltonian.	**K3**
	CO5 Solve harmonic oscillator problem using canonical-transformation and Hamiltonian Jacobi	**K3**

UNIT - I	**UNIT-I: LAGRANGIAN AND HAMILTONIAN METHODS**	**Periods: 12**
Generalized coordinates–D'Alembert's principle–Lagrangian equation of motion–Applications of Lagrange's equation of motion–Linear harmonic oscillator and simple pendulum. Cyclic co-ordinates–Hamiltonian equation of motion–Physical significance of the Hamiltonian – Hamiltonian equations form Variational principle–Principle of least action – Simple applications.		**CO1**
UNIT - II	**CENTRAL FIELD MOTION**	**Periods: 12**
Motion under a central force – General features of central force motion- Reduction of two body central force problem to the equivalent one body problem– Equation of amotion in a central field. Equation of orbit in a central field- condition for closed orbit (Bertrand's theorem)–The virial theorem–Kepler's law of planetary motion-scattering in a central force field.		**CO2**
UNIT - III	**CANONICAL TRANSFORMATIONS**	**Periods: 12**
The equation of Canonical Transformations – Examples of Canonical Transformations – Problems – Harmonic Oscillator– Lagrange and Poisson bracket –Properties and invariance of Poisson bracket-Equation of motion in Poisson bracket notation- Liouville's theorem.		**CO3**
UNIT - IV	**SMALL OSCILLATIONS**	**Periods: 12**
Formulation of the Problem-Eigen value equation and the principle axes Transformation–Frequencies of free vibrations and normal Coordinates–Free vibrations of a linear triatomic molecule and some macroscopic applications.		**CO4**

UNIT - V	HAMILTON- JACOBI THEORY	Periods: 12
Hamilton-Jacobi equation– Applications: Harmonic Oscillator and Kepler's Problem – The Hamilton –Jacobi equation for Hamilton's characteristic's function–Action and Angle variables–Harmonic Oscillator problem using action and angle variables–Kepler's problem in action-Angle variable.		CO5

Lecture Periods: 60	Tutorial Periods: 0	Practical Periods: -	Total Periods : 60

Text Books

1. H. Goldstein, Classical Mechanics, Pearson Education, Asia, New Delhi, 3rd Edition, 2002.
2. S.N. Biswas, Classical Mechanics, Books and Allied Ltd., Kolkata, 2nd Edition, 1998.
3. J.L. Synge and B.A Griffith, Principles of Classical Mechanics, Mc. Graw-Hill, New York, 2nd Edition, 1949.

Reference Books

1. L.D. Landau and E.M. Lifshitz, Mechanics, Pergomon Press, Oxford, 5th Edition, 1969.
2. T.W.B. Kibble, Classical Mechanics, Imperial College Press, 5th Edition, 2004.
3. N.C. Rana and P.S. Juog, Classical Mechanics, Mc. Graw-Hill, New York, 2nd Edition, 1973.

Web References

1. https://www.youtube.com/playlist?list=PLERGeJGfknBR3pXCPlV3bgb_qHCSNOd Bf
2. https://www.khanacademy.org/science/physics
3. https://www.askiitians.com/iit-jee-physics/mechanics/keplers-laws-motion-of- satellite.aspx

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	I	Course Category Code: DSC				End Semester Exam Type: **TE**		
Course Code	**A23PPHT102**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**MATHEMATICAL PHYSICS - I**	**4**	**0**	**0**	**4**	**25**	**75**	**100**
Prerequisite	need a superior high-level undergraduate education in *physics studied basic algebra*							
Course Objectives	To develop knowledge in mathematical physics and its applications.							
	To develop expertise in mathematical techniques required in physics.							
	To enhance problem solving skills.							
	To understand the Group theory and its applications.							
	To enable students to formulate, interpret and draw inferences from mathematical solutions.							

Course Outcomes		***On completion of the course, the students will be able to***	BT Mapping (Highest Level)
	CO1	have clear idea about vector calculus and matrices.	**K3**
	CO2	Develop knowledge in mathematical physics and its applications.	**K3**
	CO3	Understand the use of complex variables for solving definite integral.	**K3**
	CO4	Understand the applications of group theory in all the branches of Physics problems.	**K3**
	CO5	Enable students to formulate, interpret and draw inferences from mathematical solutions.	**K3**

UNIT-I	**VECTOR CALCULUS**	**Periods: 12**
Definitions & Physical significance of gradient, divergence and curl-simple problems-vector identities– line, surface and volume integrals–simple problems–Statement and proof for Gauss's divergence theorem, Stokes's theorem and Green's theorem		**CO1**
UNIT - II	**MATRICES**	**Periods: 12**
Types of Matrices–Symmetric and anti-symmetric-Hermitian and Skew Hermitian- Rank of a Matrix, Eigenvalue Equations and their solutions–Theorems on Matrices; Diagonalisation and Diagonalisation of different matrices–Cayley-Hamilton's theorem- Simple problems.		**CO2**
UNIT - III	**COMPLEX VARIABLE**	**Periods: 12**
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- Cauchy's residue theorem–poles - evaluation of residues–evaluation of definite integrals.		**CO3**
UNIT - IV	**GROUP THEORY**	**Periods: 12**
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).		**CO4**

UNIT - V	TENSORS	Periods: 12
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.		CO5

Lecture Periods: 60 **Tutorial Periods: 0** **Practical Periods: -** **Total Periods : 60**

Text Books

1. SatyaPrakash, Mathematical Physics, Sultan Chand & Sons, 6thEdition 2014.
2. B.D. Gupta, Mathematical Physics, Vikas Publishing House Pvt. Ltd, 4th Edition 2010.
3. B.S. Rajput, Mathematical Physics, Pragati Prakashan, 20th Edition, 2008.

Reference Books

1. Charlie Harper, Introduction to Mathematical Physic, Prentice Hall of India Pvt. Ltd, 6th Edition, 1993.
2. L.A. Pipes and L.R. Havevill, Applied Mathematics for Engineers and Physicists, McGraw Hill Publications Co., 3rd Edition, 2014.
3. P.K.Chattopadhyay, Mathematical Physics, New Age International Publication, 1st Edition, 1990.

Web References

1. http://www.math.pitt.edu/~sparling/14/20141540/20141540vectorspacesapril28.pdf
2. http://web.math.ucsb.edu/~jhateley/project/tensor.pdf
3. https://www.math.ust.hk/~machas/differential-equations.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	I	Course Category Code: DSC				End Semester Exam Type: **TE**		
Course Code	**A23PPHT103**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**ELECTROMAGNETIC THEORY**	**4**	**0**	**0**	**4**	**25**	**75**	**100**
Prerequisite	Basic principles of electromagnetism and properties of electromagnetic							
Course Objectives	To have clear idea about Electrostatics							
	To be familiar with electromagnetic theory							
	To understand electromagnetic concepts							
	To apply these theory and concepts to solve the Physics problems.							
	To understand the nature of electric and magnetic fields and the intricate connection between them							

Course Outcomes	***On completion of the course, the students will be able to***	BT Mapping (Highest Level)
	CO1 Learn the fundamentals of electrostatics.	**K3**
	CO2 Acquire the knowledge about magnetostatics.	**K3**
	CO3 Gain knowledge about the Maxwell equation	**K3**
	CO4 Learn about electromagnetic waves.	**K3**
	CO5 Understand the Potentials formulations and field.	**K3**

UNIT-I	**ELCTROSTATICS**	**Periods: 12**
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.		**CO1**
UNIT - II	**MAGNETOSTATICS**	**Periods: 12**
Magnetic Field–Magnetic induction- force on a current carrying conductor–Biot-Savart Law Application–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		**CO2**
UNIT - III	**ELECTRODYNAMICS**	**Periods: 12**
Electromagnetic Induction-Faradays Law – The induced electric field – Energy in magnetic fields - Maxwell's equations- electrodynamics Before Maxwell – How Maxwell fixed Ampere's law - Maxwell's equations –Magnetic charge Maxwell's equations in matter – Boundary Conditions.		**CO3**
UNIT - IV	**ELECTROMAGNETIC WAVES**	**Periods: 12**
Waves in one dimension –Thewave equation – sinusoidal waves –Electromagnetic waves in vacuum– The 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–absorption and dispersion –electromagnetic waves in conductors.		**CO4**
UNIT - V	**POTENTIALS AND FIELDS**	**Periods: 12**

The Potential formulation - Scalar and Vector Potentials- Gauge Transformation - Coulomb Gauge and Lorentz Gauge – Lorentz force law in potential form – continuous distributions – retarded potentials –Jefimenko's equations – point charge –Lienard-Wiechert potentials.	**CO5**

Lecture Periods: 60 **Tutorial Periods: 0** **Practical Periods: -** **Total Periods : 60**

Text Books

1. SathyaPrakash, Electromagnetic Theory and Electrodynamics, Kedarnath Ramnath and Co, 1st Edition, 2019.
2. B.B Laud, Electromagnetics, New Age International Publisher, 3rd Edition, 2011.
3. WazedMiah, Fundamentals of Electromagnetics, Tata McGraw Hill, 2nd Edition, 1992.

Reference Books

1. J.D. Jackson, Classical Electrodynamics, Wiley Eastern Limited, 2ndEdition, 1993.
2. Narayanarao, Basic Electromagnetics with Application, (EEE) Prentice Hall, 1997.
3. D.J. Griffiths, Introduction to Electrodynamics, Prentice-Hall of India, New Delhi, 4th Edition, 2017.

Web References

1. https://ecee.colorado.edu/~bart/book/book/chapter1/ch1_3.htm
2. http://www.clerkmaxwellfoundation.org/html/electromagnetic_theory.html
3. https://ocw.mit.edu/courses/physics/8-311-electromagnetic-theory-spring-2004/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	I	Course Category Code: DSE				End Semester Exam Type: **TE**		
Course Code	**A23PPHE101**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**DIGITAL ELECTRONICS PRINCIPLES**	**4**	**0**	**0**	**4**	**25**	**75**	**100**
Prerequisite	Basic understanding of diode, transistor operation							
Course Objectives	To prepare students to perform the analysis and design of various digital electronic circuits.							
	To understand the concepts of transistors							
	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.							
	To know the concepts of Combinational circuits.							
	To gain the knowledge between digital analog and analog to digital							

Course Outcomes	***On completion of the course, the students will be able to***	BT Mapping (Highest Level)
	CO1 outline semiconductor devices, examine the Analog and digital circuits and identify the states and working characteristics of circuits.	**K3**
	CO2 describe and discuss functional blocks of Analog and Digital Electronics.	**K3**
	CO3 list and use the methods to examine Analog and digital circuit problems.	**K3**
	CO4 assess the limitations of Analog and Digital circuits and recommend the solutions	**K3**
	CO5 design and construct Analog and Digital circuits for demand.	**K3**

UNIT-I	**BAND THEORY OF SOLIDS**	**Periods: 12**
Semiconductors - Energy band description of semiconductors- Intrinsic semiconductor - Extrinsic Semiconductor – n-type semiconductor - p-type semiconductor - Charge on n-type and p-type semiconductors - Majority and minority carriers – pn junction - Volt-ampere characteristics of pn junction - Zener diode – Light Emitting (LED) Photo diode - Tunnel diode.		**CO1**
UNIT - II	**SPECIAL DEVICES AND APPLICATIONS**	**Periods: 12**
Field Effect Transistors (FET) - Characteristics – parameter FET as amplifier – FET as Voltage variable resistor (VVR) – Metal Oxide Semiconductor (MOSFET) – Depletion and enhancement – UniJunction Transistor (UJT) characteristics – UJT as relaxation oscillator – Silicon controlled Rectifier (SCR) characteristics.		**CO2**
UNIT - III	**LINEAR OPERATIONAL AMPLIFIER CIRCUITS**	**Periods: 12**
OPAMP – Parameters – inverting and Non-inverting amplifier – gain – Miller effect – Virtual ground – offset voltage – offset current – Power Supply Ripple Ratio (PSRR) – Common Mode Rejection Ratio (CMRR) - OPAMP – Sign and scale changer – adder, subtractor and averager – integrator and differentiator – voltage follower – solving simultaneous linear equation.		**CO3**
UNIT - IV	**TRANSISTOR**	**Periods: 12**
Transistor - Basic configurations – Common Base (CB), Common Emitter (CE) and Common Collector (CC) mode - Transistor action - Relation between α, β and γ - DC load line - DC bias and stabilization - AC load line, transistor biasing -Fixed bias - Voltage divider bias – Transistor as a two part network – hybrid 'h' parameter.		**CO4**
UNIT - V	**D / A AND A / D CONVERTER**	**Periods: 12**
555 Timer block diagram - Monostable operation – A stable operation – Schmitt trigger. Phase – Locked Loops (PLL): Basic principles – phase Detector- Analog phase detector – Digital phase detector – voltage controlled oscillator (VCO). Weighted resistor D/A converter – 4bit R-2R ladder DAC – Analog to Digital converter – Stair case ADC– Successive approximation ADC.		**CO5**

Lecture Periods: 60	Tutorial Periods: 0	Practical Periods: -	Total Periods : 60

Text Books

1. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Prentice Hall New Jersey, 7th edition.
2. Jacob Millman and Christos C. Halkias, "Microelectronics", 2nd edition, McGraw Hill, New Delhi, 2009.
3. Victor P. Nelson, "Digital logic circuit analysis and design", Prentice Hall, 1995.

Reference Books

1. Anant Agarwal, Jeffrey H. Lang, "Foundation of analog and digital circuits", Elsevier, 2005.
2. Daniel Adam Steck, "Analog and Digital Electronics", 2017.
3. Hubert Kaeslin, "Digital Integrated Circuit Design", Cambridge University Press, 2003.

Web References

1. https://www.electronicshub.org/analog-circuits-and-digital- Circuits
2. https://www.allaboutcircuits.com/video-tutorials/analog-and-digital-electronics/
3. https://www.ece.utoronto.ca/prospective-students/curriculum-streams/digital-analog

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	I	Course Category Code: DSE				End Semester Exam Type: **TE**		
Course Code	**A23PPHE102**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**INSTRUMENTATION**	**4**	**0**	**0**	**4**	**25**	**75**	**100**
Prerequisite	Fundamentals of sensors and transducers, divider and bridge circuits, op-amp circuits in instrumentation							
Course Objectives	To understand the types of transducer for a particular measurement.							
	To develop knowledge in digital, analytical and biomedical instruments for different applications.							
	To understand the principle and working of analytical instruments.							
	To know the functioning of medical imaging instruments							
	To have idea about measurement of physiological parameters.							
Course Outcomes	***On completion of the course, the students will be able to***							BT Mapping (Highest Level)
	CO1	Understand the types of transducer for a particular measurement.						**K3**
	CO2	Test and use the digital instruments for different applications.						**K3**
	CO3	Understand the various analytical and biomedical instrumentation and their uses						**K3**
	CO4	Know the functioning of medical imaging instruments.						**K3**
	CO5	Understand the measurement of Physiological Parameters.						**K3**
UNIT-I	**TRANSDUCERS**							**Periods: 12**
Basic functional elements of measuring system-Transducers: Definition-Parts-Classification-Types of primary sensing element. LVDT: Principle –Working –Measurement of displacement. Electrical Strain Gauge: Principle-Theory-Types-Working -Measurement of Force (or) Pressure. Capacitive Transducers: Principle-Types-Working-Measurement of linear and angular displacement.								**CO1**
UNIT - II	**DIGITAL INSTRUMENTATION**							**Periods: 12**
Principle, block diagram and working of Digital Multimeter, Digital Frequency counter, Digital pHmeter, Digital conductivity meter, Digital storage Oscilloscope and Q-meter.								**CO2**
UNIT - III	**ANALYTICAL INSTRUMENTATION**							**Periods: 12**
Principle, working, Instrumentation and applications of UV-Vis Spectrophotometer, ICPAES, (Inductively coupled plasma-Atomic emission spectroscopy), SEM (Scanning Electron Microscope) and AFM (Atomic Force Microscopy).								**CO3**
UNIT - IV	**MEASUREMENT OF PHYSIOLOGICAL PARAMETERS**							**Periods: 12**
Magnetic Resonance Imaging: Principle-Magnetic resonance phenomena-Magnetic resonance imaging-Imaging process-Instrumentation. Ultrasonic Imaging System: Principle-**Construction** of an ultrasonic transducer-Ultrasonic propagation through tissues-Display-A mode- B mode- M mode-TM mode.								**CO4**
UNIT - V	**MEASUREMENT OF PHYSIOLOGICAL PARAMETERS**							**Periods: 12**
Blood Pressure Measurement-Introduction-Direct Measurement using Catheters Advance of Direct Method-Indirect Method-Oscillometric measurement method. Electromagnetic Blood Flow Meters-Ultrasonic Blood Flow Meter-transit time method. Doppler Effect based ultrasonic blood flow meter.								**CO5**

Lecture Periods: 60	Tutorial Periods: 0	Practical Periods: -	Total Periods : 60

Text Books

1. A.K.Sawhney, A course in Electrical and Electronics Measurement and Instrumentation, DhanpathRai and Co., Pvt., Ltd., 2000.
2. Dr.Rajendra Prasad, Electronic Measurements and Instrumentation, Khanna Publishers, 4th Edition, 2012
3. M.Arumugam, Biomedical Instrumentation, Anuradha Publishers, 2001.

Reference Books

1. Willard.D. Merritet.al. Instrumental methods of analysis, CBS Publishers, 7th Edition, 2004.
2. R.S.Khandpur, Hand Book of Biomedical Instrumentation, TMH, 3rd Edition, 2007.
3. S.K.Venkata Ram, Biomedical Electronics and Instrumentation, Galgotia Publications Pvt. Ltd., 3rdEdition, 2001.

Web References

1. https://www.sciencedirect.com/topics/engineering/physiological-parameter
2. https://revistaeduweb.org/index.php/eduweb/article/view/397
3. https://www.nanoscience.com/techniques/scanning-electron-microscopy

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	I	Course Category Code: DSE				End Semester Exam Type: **TE**		
Course Code	**A23PPHE103**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**PHYSICS OF NANOMATERIALS**	**4**	**0**	**0**	**4**	**25**	**75**	**100**
Prerequisite	*knowledge* of physics, chemistry, material science, and biology							
Course Objectives	To impart the basic knowledge on the exotic properties of nano-structured materials.							
	To acquire the knowledge on various nano-particles process methods and their skills. and to study the reactive merits of various process techniques							
	To understand the various characterization techniques and advantages.							
	To understand the Properties of Nanomaterial's							
	To teach the applications of nanomaterials in various fields							

Course Outcomes	***On completion of the course, the students will be able to***		BT Mapping (Highest Level)
	CO1	Gain knowledge on the synthesis of Nanomaterials and their merits.	**K3**
	CO2	Students would gain perception of characterization techniques.	**K3**
	CO3	Understand the differentiate quantum structures and its confinement phenomena.	**K3**
	CO4	Understanding of optical and Electron transport properties of nanomaterials.	**K3**
	CO5	Gain Knowledge on wide Applications of Nano materials	**K3**
UNIT-I	**NANOSCALE SYSTEMS**		**Periods: 12**
Length scales in physics - Surface-volume-ratio - Nanostructures: 3D, 2D and 1D nanostructures (nanocrystals, thin films and nanowires) - Band structure and density of states of materials at nanoscale - Size Effects in nano systems - Quantum confinement: particle in a box - carriers in 3D, 2D, 1D and its consequences.			**CO1**
UNIT - II	**SYNTHESIS OF NANOSTRUCTURE MATERIALS**		**Periods: 12**
Top down and Bottom up approach - Introduction to Microelectronics - Moore's law - importance of lithographic techniques - Ball milling - Gas phase condensation - Vacuum deposition - Physical vapor deposition (PVD): Thermal evaporation - E-beam evaporation - DC/RF magnetron sputtering - Pulsed Laser deposition- Chemical methods: Chemical vapor deposition (CVD) - Sol-Gel - Electro deposition - Hydrothermal synthesis - Colloidal methods.			**CO2**
UNIT - III	**CHARACTERIZATION**		**Periods: 12**
Field Emission Scanning Electron Microscopy (FESEM) – X-ray photoelectron spectroscopy (XPS) – Auger Electron Spectroscopy (AES) - Energy Dispersive x-ray spectroscopy (EDS) - Transmission Electron Microscopy (TEM) - Scanning probe Microscopy: Scanning Tunneling Microscopy (STM) - Atomic Force Microscopy (AFM) - Scanning Near filed optical microscopy (SNOM).			**CO3**
UNIT - IV	**PROPERTIES**		**Periods: 12**
Radiative processes: General formalization – absorption - emission and luminescence - Optical properties of hetero strctures and nanostructures - Coulomb interaction in nanostructures - Quasi-particles and excitons- Excitons in semiconductors - Plasmonics - Surface Plasmon Resonance (SPR). Carrier transport in low- dimensional systems (LDS) - Coulomb blockade effect - SET phenomena - Thermionic emission - tunneling and hoping conductivity Quantum Hall effect-topological insulators.			**CO4**
UNIT - V	**APPLICATIONS**		**Periods: 12**
Applications of nanoparticles, nanowires and thin films for LED, Laser Diode and solar cells - Single electron devices – Nanoelectronics.			**CO5**

Lecture Periods: 60	Tutorial Periods: 0	Practical Periods: -	Total Periods : 60

Text Books

1. Charles P. Poole, Jr. and F. J. Owens, Introduction to Nanotechnology, John Wiley &Sons, 2007.
2. S. K. Kulkarni, Nanotechnology: Principles & Practices, Wiley, Capital Publishing Company, 3rd Edition, 2011.
3. K.K. Chattopadhyay and A. N. Banerjee, Introduction to Nanoscience and Technology, PHI Learning Pvt. Lmt. 2009

Reference Books

1. John H. Davies, The principles of low-dimensional semiconductors an introduction, Cambridge University Press, 1st Edition, 1998.
2. Paul Harrison, Quantum Wells, Wires and Dots: Theoretical and Computational Physics of Semiconductor Nanostructures, John Wiley & Sons, 2ndEdition, 2005.
3. P.J. Good hew, J.Humphreys, R.Beanland, Electron Microscopy and Analysis, 3rd Edition, CRC Press Taylor and Francis, 2001.

Web References

1 https://www.oreilly.com/library/view/engineeringphysics/9788131775073/xhtml/ch13-sub13.1.xhtml
2. https://www.news-medical.net/life-sciences/Properties-of-Nanoparticles.aspx

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	I	Course Category Code: DSC				End Semester Exam Type: **PE**		
Course Code	**A23PPHL101**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**GENERAL PRACTICAL – I ``**	**0**	**0**	**4**	**2**	**50**	**50**	**100**
Prerequisite	Basics of Physics experiments							
Course Objectives	To Acquire strong laboratory skills.							
	To provide a practical understanding of some of the concepts learnt in the theory course on Physics.							
	To evaluate the process and outcomes of an experiment quantitatively and qualitatively.							
	To inculcate strong laboratory skills.							
	To make the students gain a practical knowledge in the basics of Physics.							

Course Outcomes	***On completion of the course, the students will be able to***	BT Mapping (Highest Level)
	CO1 Understand the concepts behind various physics experiments.	**K3**
	CO2 Understand the basics of experimental physics	**K3**
	CO3 Explore the concepts involved in the thermodynamics, heat and modern optics	**K3**
	CO4 Create the knowledge of theories involved in physics using practical experiments	**K3**
	CO5 Enhance the skill to meet the present-day requirements in industries, researchfields	**K3**

(Choose any 8 experiments from the list given below)

LIST OF EXPERIMENTS

1. Determination of Stephan's constant.
2. Young's Modulus by elliptical fringes.
3. Young's Modulus by hyperbolic fringes.
4. Determination of band gap in semiconductor.
5. Hydrogen spectrum – Rydberg's constant.
6. Viscosity of liquid – Meyer's disc.
7. Spectrometer - Specific charge of an electron.
8. Fiber Optics Experiment.
9. Ultrasonic diffraction.
10. Laser- Thickness of the enamel coating on a wire by diffraction.

Lecture Periods: 0 **Tutorial Periods: 0** **Practical Periods: 30** **Total Periods : 30**

Text Books

1.C.C Ouseph, V.J.Rao and V. Vijayendran "Practical Physics"

2.M.N. Srinivasan "Practical Physics", Sultan son Pub.

3.D P Khandelwal, "Laboratory Manual of Physics" for UG classes (Vani Pub. House, New Delhi)..

Reference Books

1. V Y Rajopadhye and V L Purohit, Text book of experimental Physics

2.C.C Ouseph, V.J.Rao and V.Vijayendran "Practical Physics"

Web References

1. https://www.tvu.edu.in/wp-content/uploads/2017/06/B-Sc-Physics.pdf
2.https://www.physics.louisville.edu/cldavis/phys298/notes/torpend.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	Observation	Model Exam	Viva Voce	Attendance		
Marks	15	15	10	10	50	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	I	Course Category Code: DSC				End Semester Exam Type: **PE**		
Course Code	**A23PPHL102**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**ELECTRONICS PRACTICAL – I** `	**0**	**0**	**4**	**2**	**50**	**50**	**100**
Prerequisite	Basics of Physics experiments							
Course Objectives	To provide a practical understanding of some of the concepts learnt in the theory course on Physics.							
	To evaluate the process and outcomes of an experiment quantitatively and qualitatively.							
	To give hands on training in the construction of simple electronic circuits.							
	To inculcate strong laboratory skills.							
	To make the students gain a practical knowledge in the basics of Physics.							

Course Outcomes	***On completion of the course, the students will be able to***	BT Mapping (Highest Level)
CO1	Understand the concepts behind various physics experiments.	**K3**
CO2	Understand the basics of experimental physics	**K3**
CO3	Explore the concepts involved in the thermodynamics, heat and modern optics	**K3**
CO4	Create the knowledge of theories involved in physics using practical experiments	**K3**
CO5	Enhance the skill to meet the present day requirements in industries, research fields	**K3**

(Choose any 8 experiments from the list given below)

LIST OF EXPERIMENTS

1. FET Characteristics and amplifier design
2. UJT characteristics and applications
3. Design of a Regulated Power Supply using IC7805.
4. Design full adder and full subtractor and verify its truth table using NAND logic gates.
5. Design full adder and full subtractor and verify its truth table using NOR logic gates.
6. Construct a stable multivibrator using transistor and to determine the frequency of oscillation.
7. Design an astable multivibrator using 555 timer.
8. Design 4 bit shift register using JK Flip flop.
9. Design multiplexer/demultiplexer.
10. Op-amp – Inverting, non-inverting amplifier – Voltage follower- summing, difference,average amplifier – differentiator and integrator.

Lecture Periods: 0 **Tutorial Periods: 0** **Practical Periods: 30** **Total Periods : 30**

Text Books

1. C.C Ouseph, V.J.Rao and V. Vijayendran “Practical Physics”
2. M.N. Srinivasan “Practical Physics”, Sultan son Pub.
3. D P Khandelwal, “Laboratory Manual of Physics” for UG classes (Vani Pub. House, New Delhi)..

Reference Books

1.V Y Rajopadhye and V L Purohit, Text book of experimental Physics
2.C.C Ouseph, V.J.Rao and V.Vijayendran “Practical Physics”

Web References

1. https://www.tvu.edu.in/wp-content/uploads/2017/06/B-Sc-Physics.pdf
2. https://www.physics.louisville.edu/cldavis/phys298/notes/torpend.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	Observation	Model Exam	Viva Voce	Attendance		
Marks	15	15	10	10	50	100

Department	PHYSICS		Programme: **M. Sc.Physics**						
Semester	I		Course Category Code: DSE				End Semester Exam Type: **TE**		
Course Code	**A23PPHS101**		Periods/Week			Credit	Maximum Marks		
			L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**PROFESSIONAL SKILLS**		**0**	**0**	**4**	**2**	**100**	**-**	**100**
Prerequisite									
Course Objectives	To Enable the students to understand the importance of Interpersonal and Team skills.								
	To Acquire Different Interpersonal and Team skills to be an employable person.								
	To know how to communicate in an emotionally intelligent way.								
	To identify needed information and/or eliminate extraneous information towards solving contextual problems.								
	To achieve the desired result of a good employability through Team work.								
Course Outcomes	***On completion of the course, the students will be able to***								BT Mapping (Highest Level)
	CO1	Remember the various Interpersonal skill requirements in organizational entry level							**K3**
	CO2	Understand t h e need for different communication skill requirement at different occasions							**K3**
	CO3	Understand what Emotional Intelligence is and why it is important							**K3**
	CO4	Demonstrate a good Problem-solving skill in work environment							**K3**
	CO5	Demonstrate their ability in team work to achieve desired result							**K3**
UNIT-I	**INTRODUCTION TO INTERPERSONAL SKILL**								**Periods: 6**
Introduction to Interpersonal skills – definition – Importance of interpersonal skills - Developing Your Interpersonal Skills – Types of Interpersonal relationships – uses of Interpersonal relationships skills – Factorsaffecting Interpersonal Relationships – How to accommodate different styles – consequences of Interpersonal relationships									**CO1**
UNIT - II	**COMMUNICATION SKILLS**								**Periods: 6**
Introduction – Meaning – Process of communication – Tools for communication – Verbal communication – Non – Verbal communication – Dealing with Conflict – Communication Barriers.									**CO2**
UNIT - III	**EMOTIONAL INTELLIGENCE**								**Periods: 6**
Emotional intelligence, emotional quotient, ability to understand, use manage own emotions, positive waysto relieve stress, empathy and resolving conflict.									**CO3**
UNIT - IV	**PROBLEM SOLVING**								**Periods: 6**
Introduction – Need for problem Solving – Skills for Problem Solving –Process of Problem solving – Stagesof problem solving – Methods of Problem solving									**CO4**
UNIT - V	**TEAM SPIRIT AND GROWTH**								**Periods: 6**

Team spirit, growth mindset, high performing teams, trust and mind alignment, focus, target achievement and time compliance.	**CO5**

Lecture Periods: 30	**Tutorial Periods: 0**	**Practical Periods: -**	**Total Periods : 30**

Text Books

1. 1. Brooks,Margret. Skills for Success. Listening and speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

Reference Books

1. Bhatnagar, Nitin and MamtaBhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	70			20	10	100	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS		Programme: **M. Sc. Physics**					
Semester	II		Course Category Code: DSC			End Semester Exam Type: **TE**		
Course Code	**A23PPHT204**		Periods/Week			Credit	Maximum Marks	
			L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**STATISTICAL MECHANICS**		**4**	**0**	**0**	**4**	**25**	**75**	**100**
Prerequisite	need a superior high-level undergraduate education in *physics studied basic algebra*								
Course Objectives	To understand the concepts of various ensembles and quantum statistics in detail.								
	To understand the Partition function								
	To know the concepts of independent particles								
	To learn the basic ideas and concepts of quantum statistics								
	To learn thermodynamical behavior properties								
Course Outcomes	***On completion of the course, the students will be able to***								BT Mapping (Highest Level)
	CO1	Study the nature of statistical mechanics							**K3**
	CO2	Understand the concepts of various ensembles							**K3**
	CO3	Study statistics of systems of independent particles							**K3**
	CO4	Understand the concepts quantum statistics							**K3**
	CO5	Understand the fluctuations and Transport Properties of materials							**K3**
UNIT-I	**Foundations Of Statistical Mechanics:**								**Periods: 12**
Phase space- States of a system- Micro canonical ensemble- Density of states- Liouville's theorem- Statistical equilibrium- Relation between statistical and thermo dynamical quantities- Boltzmann entropy relation- Classical ideal gas- Entropy of mixing- Gibb's paradox.									**CO1**
UNIT - II	**Partition Function:**								**Periods: 12**
Ensemble-canonical, Micro canonical and grand canonical ensembles - Partition function - Relation between partition function and thermo dynamical quantities - Entropy – Helmholtz free energy – Total energy – Enthalpy - Gibb's potential – pressure - specific heat CV.									**CO2**
UNIT - III	**Statistics Of Systems of Independent Particles:**								**Periods: 12**
Quantum picture – Maxwell Boltzmann, Bose Einstein and Fermi Dirac statistics - Limit of applicability of the three distribution laws- MB ideal gas - Equipartition law of energy - Classical real gas - Maxwell's law of distribution of velocities – most probable speed, mean speed, root mean square speed									**CO3**
UNIT - IV	**Quantum Statistics:**								**Periods: 12**
Ideal BE gas - Gas degeneracy - BE condensation – Photon gas - Plank's law of radiation - Phonon gas - Einstein and Debye's models for specific heat of solids. Ideal FD gas - Gas degeneracy - Electron gas – Pauli's theory of paramagnetism - White dwarfs									**CO4**
UNIT - V	**Fluctuations and Transport Properties:**								**Periods: 12**

Fluctuations in Energy, pressure, volume & enthalpy - density fluctuation- Correlation of space-time dependent fluctuation- Fluctuation dissipation theorem - Transport properties – Boltzmann transport equation-Random walk- Brownian motion.	**CO5**

Lecture Periods: 60	**Tutorial Periods: 0**	**Practical Periods: -**	**Total Periods : 60**

Text Books

1. Agarwal B.K. and Melvin Eisner, Statistical Mechanics, New Age International Publishers. 2015
2. Kerson Huang, Statistical Mechanics, Wiley Eastern Ltd.1987
3. Gupta and Kumar, Elements of Statistical Mechanics, Meerut, Pragathi Prakasham 1995

Reference Books

1. Gupta M. C, Statistical Thermodynamics, New Age International Publishers 1995
2. Gopal ESR, Statistical Mechanics & Properties of Matter, The Macmillan Co. of IndiaLtd. 1976
3. Laud B.B, Fundamentals of statistical Mechanics, New Age International Publishers 1951

Web References

1. https://www.cambridge.org/core/elements/foundations-of-statistical-mechanics/6413B95F18EFDD5259DDAEB90E388031
2. https://www.sciencedirect.com/topics/chemistry/partition-function
3. https://phys.libretexts.org/Bookshelves/Thermodynamics_and_Statistical_Mechanics/Book%3A_Statistical_Mechanics_(Styer)/06%3A_Quantal_Ideal_Gases/6.04%3A_Statistical_Mechanics_of_Independent_Identical_Particles

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	II	Course Category Code: DSE				End Semester Exam Type: **TE**		
Course Code	**A23PPHT205**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**Mathematical Physics II**	**4**	**0**	**0**	**4**	**25**	**75**	**100**
Prerequisite	*knowledge* of mathematics studied in UG							
Course Objectives	To develop knowledge in mathematical physics and its applications.							
	To develop expertise in mathematical techniques required in physics.							
	To enhance problem solving skills.							
	To enable students to formulate, interpret and draw inferences from mathematical solution.							
	To teach the mathematical correlation occurred.							

Course Outcomes	***On completion of the course, the students will be able to***	BT Mapping (Highest Level)
	CO1 Develop knowledge in mathematical physics and its applications.	**K3**
	CO2 Develop expertise in mathematical techniques required in physics.	**K3**
	CO3 Use differential equations and special functions to solve mathematical problems of interest in Physics.	**K3**
	CO4 Enable students to formulate, interpret and draw inferences from mathematical solutions.	**K3**
	CO5 Gain the knowledge about the Integral transforms	**K3**
UNIT-I	**DIFFERENTIAL EQUATIONS**	**Periods: 12**
Homogeneous linear equations of second order with constant coefficients and their solutions – ordinary second order differential with variable coefficients and their solution by power series and Frobenius methods – extended power series method for indicial equations.		**CO1**
UNIT - II	**SPECIAL FUNCTIONS –I**	**Periods: 12**
Gamma and Beta function– Legendre's differential 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.		**CO2**
UNIT - III	**PARTIAL DIFFERENTIAL EQUATIONS**	**Periods: 12**
Solution of Laplace Differential Equation – Two-dimensional flow of heat in cartesian and cylindrical co-ordinates. Solution of heat flow equation in one dimension – Solution of wave equation – Transverse vibrations of a stretched string.		**CO3**
UNIT - IV	**INTEGRAL TRANSFORMS**	**Periods: 12**
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 – Solution of differential equation.		**CO4**
UNIT - V	**PROBABILITY AND STATISTICS**	**Periods: 12**
Events - Sample Space - Mathematical and Statistical definitions of Probability - Random variables – Distribution function – Discrete random variable – Continuous random variable – Continuous distribution function –Mathematical expectation and variance-Poisson distribution - Normal distribution – Properties of normal distribution – Mean, Median, Mode.		**CO5**

Lecture Periods: 60 **Tutorial Periods: 0** **Practical Periods: -** **Total Periods : 60**

Text Books

1. Satya Prakash, Mathematical Physics, Sultan Chand & Sons, 6th Edition, 2014.
2. B.D. Gupta, Mathematical Physics, Vikas Publishing House Pvt. Ltd, 6th Edition, 2010.
3. B.S. Rajput, Mathematical Physics, PragatiPrakashan, 31st Edition, 2019.
4. P.K. Chattopadhyay, Mathematical physics, Wiley Eastern Limited, 1st Edition, 1990.

Reference Books

1. Charlie Harper, Introduction to Mathematical Physics, Prentice Hall of India Pvt. Ltd, 2ndEdition, 1993.
2. L.A. Pipes and L.R. Havevill, Applied Mathematics for Engineers and Physicists, McGraw Hill Publications Co., 3rd Edition, 2014.
3. Murray R. Spigel, Theory and Problems of Laplace Transforms, Schaum's outline series, McGraw Hill, 4thEdition, 1986.
4. L.A. Pipes and L.R. Havevill, Applied Mathematics for Engineers and Physicists, 3rd Edition, McGraw Hill, 1971.

Web References

1. http://www.math.pitt.edu/~sparling/14/20141540/20141540vectorspacesapril28.pdf
2. http://web.math.ucsb.edu/~jhateley/project/tensor.pdf
3. https://www.math.ust.hk/~machas/differential-equations.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	II	Course Category Code: DSE				End Semester Exam Type: **TE**		
Course Code	**A23PPHT206**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**Quantum Mechanics - I**	**4**	**0**	**0**	**4**	**25**	**75**	**100**
Prerequisite	*knowledge* of mathematics and wave mechanics studied in UG							
Course Objectives	To develop the physical principles and the mathematical background important to quantum mechanical descriptions.							
	To describe the propagation of a particle in a simple, one-dimensional potential.							
	To formulate and solve the Schrodinger's equation to obtain eigenvectors and energies for particle in a three-dimensional and spherically symmetric potentials.							
	To explain the mathematical formalism and the significance of constants of motion, and see their relation to fundamental symmetries in nature							
	To discuss the Approximation methods like perturbation theory, Variational and WKB methods for solving the Schrodinger equation.							

Course Outcomes	***On completion of the course, the students will be able to***	BT Mapping (Highest Level)
	CO1 Demonstrates a clear understanding of the basic postulates of quantum mechanics which serve to formalize the rules of quantum mechanics	**K3**
	CO2 Able to apply and analyse the Schrodinger equation to solve one dimensional problems	**K3**
	CO3 Apply and analyse the Schrodinger equation for particles in different three -dimensional potentials	**K3**
	CO4 Discuss the various representations, space time symmetries and formulations of time evolution	**K3**
	CO5 Formulate and analyse the approximation methods for various quantum mechanical problems	**K3**

UNIT-I	**BASIC FORMALISM**	**Periods: 12**
Postulates of quantum mechanics- Schrodinger equations (Time dependent and Tine independent)- expectation value (problems) - operators - operator algebra –eigen values and eigen functions of Operators-Hermitian operators and their properties - simultaneous measurability and commutators (problems) - Uncertainty principle for operators - Ehrenfest's theorem.		**CO1**
UNIT - II	**APPLICATIONS OF SCHRODINGEREQUATION- ONE DIMENSION**	**Periods: 12**
The free particle- square well potential – rigid walls (problems)- finite walls- potential barrier - barrier penetration – alpha emission - simple harmonic oscillator – Schrödinger Method - ladder operator method (problems).		**CO2**
UNIT - III	**APPLICATIONS OF SCHRODINGEREQUATION- THREE DIMENSION**	**Periods: 12**
Simple harmonic oscillator (problems) -orbital angular momentum- Eigen value spectrum for L^2 and L_z - particle moving in a spherically symmetric potential- system of two interacting particles - hydrogen atom		**CO3**
UNIT - IV	**GENERAL FORMALISM**	**Periods: 12**

Linear vector space - Hilbert space – Dirac's notation - Heisenberg's matrix representation of wave functions and operators -momentum representation-wave functions, operators and Schrödinger equation-parity and time reversal- quantum mechanical pictures - Schrödinger, Heisenberg and Interaction pictures.		**CO4**
UNIT - V	**APPROXIMATION METHODS**	**Periods: 12**
Time-independent perturbation theory for non-degenerate and degenerate levels – Stark effect in hydrogen atom - Variation method – helium atom - WKB approximation - bound states in a potential well-application to simple harmonic oscillator.		**CO5**
Lecture Periods: 60	**Tutorial Periods: 0** **Practical Periods: -**	**Total Periods : 60**

Text Books

1. P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics, 2nd edition (37th Reprint), Tata McGraw-Hill, New Delhi, 2010.
2. David J Griffiths, Introduction to Quantum Mechanics. 4th edition, Pearson, 2011.
3. Nouredine Zettili, Quantum mechanics concepts and applications, 2nd Edition, Wiley, New Delhi,2017.

Reference Books

1. E. Merzbacher, Quantum Mechanics, 2nd Edition, John Wiley and Sons, New York, 1970.
2. L. D. Landau and E. M. Lifshitz, Quantum Mechanics, 1st edition, Pergomon Press, Oxford, 1976.
3. R. P. Feynman, R. B. Leighton, and M. Sands, The Feynman Lectures on Physics, Vols. 3, Narosa Publishing House, New Delhi, 1998.

Web References

1. http://research.chem.psu.edu/lxjgroup/download_files/chem565-c7.pdf
2. http://www.feynmanlectures.caltech.edu/III_20.html
3. http://web.mit.edu/8.05/handouts/jaffe1.pdf 4.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

DISCIPLINE SPECIFIC ELECTIVE

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	II	Course Category Code: DSE				End Semester Exam Type: **TE**		
Course Code	**A23PPHE204**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**ATMOSPHERIC PHYSICS**	**4**	**0**	**0**	**4**	**25**	**75**	**100**
Prerequisite	*knowledge* of Astronomical behavior studied in UG							
Course Objectives	To understand basics of structure and properties of earth's atmosphere							
	To interpret the various atmospheric processes							
	To realize the fundamental science behind the weather events							
	To know the basic concepts of cloud Physics							
	To discuss the dynamics changes in atmosphere							

Course Outcomes	***On completion of the course, the students will be able to***	BT Mapping (Highest Level)
	CO1 Know the basics of earth's atmosphere	**K3**
	CO2 Analyze the general weather phenomena	**K3**
	CO3 Interpret the various extreme weather events	**K3**
	CO4 Develop ideas of climate systems and their influence	**K3**
	CO5 Understand the significance of atmospheric processes and the laws governing them	**K3**

UNIT-I	**BASICS OF EARTH'S ATMOSPHERE**	**Periods: 12**
A Brief Survey of the Atmosphere: Chemical Composition - Vertical structure - Components of the Earth System - The Oceans - The Cryosphere - The Terrestrial Biosphere - Roles of Various Components of the Earth System in Climate - The Hydrologic Cycle and Its components- Solar Constant - Incoming and outgoing radiation of earth - Radiation Budget.		**CO1**
UNIT - II	**ATMOSPHERIC THERMODYNAMICS - I**	**Periods: 12**
Gas Laws -Virtual Temperature -The Hydrostatic Equation - Geopotential - Scale Height and the Hypsometric Equation - Thickness and Heights of Constant Pressure Surfaces - The First Law of Thermodynamics - Joule's Law - Specific Heats – Enthalpy - Adiabatic Processes - Concept of an Air Parcel		**CO2**
UNIT - III	**ATMOSPHERIC THERMODYNAMICS - II**	**Periods: 12**
Water Vapor in Air - Moisture Parameters - Latent Heats - Physics of Scattering and Absorption and Emission - Scattering by Air Molecules and Particles -Absorption by Particles - Absorption and Emission by Gas Molecules - Absorption and Emission of Infrared Radiation in Cloud-Free Air - Vertical Profiles of Radiative Heating Rate.		**CO3**
UNIT - IV	**CLOUD PHYSICS**	**Periods: 12**
Nucleation of Water Vapor Condensation, Theory - Cloud Condensation Nuclei - Cloud Classification - terminal velocity - Microstructures of Warm Clouds - and Wet-Bulb Potential Temperature Cloud Liquid Water Content and Entrainment - Growth of Cloud Droplets in Warm Clouds : Growth by Condensation - Bridging the Gap between Droplet Growth by Condensation and Collision–Coalescence.		**CO4**

UNIT - V	ATMOSPHERIC DYNAMICS	Periods: 12
The Effect of Friction - The Gradient Wind & The Thermal Wind - The Atmospheric General Circulation -The Kinetic Energy Cycle - Atmospheric Boundary Layer and its structure - Estimation of Atmospheric Boundary Layer - Tropical Cyclones - Structure, Thermodynamics, and Dynamics.		CO5

Lecture Periods: 60 **Tutorial Periods: 0** **Practical Periods: -** **Total Periods : 60**

Text Books

1. John M Wallace and Peter V Hobbs, Atmospheric Science – An introductory Survey, International Geophysics Series, 2nd Edition 2006
2. Murry L Salby, Fundamentals of Atmospheric Physics, International Geophysics Series, 2nd Edition 1996
3. Chandrasekhar, Basics of Atmospheric Science, PHI Learning Pvt Ltd, New Delhi, 2nd Edition 2010.

Reference Books

1. KshudiramSaha, The Earth's Atmosphere, Its Physics and Dynamics, Springer, 2nd Edition 2008
2. C. Donald Ahrens, Essentials of Meteorology: An invitation to the atmosphere, Cengage Learning, 3rd Edition 2010
3. John G. Harvey, Atmosphere and Ocean, the Artemis Press, 1st Edition 1995.

Web References

1. https://en.wikipedia.org/wiki/Atmosphere
2. https://weatherstationguide.com/measure-wind-speed/
3. https://en.wikipedia.org/wiki/Thunderstor

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	II	Course Category Code: DSE				End Semester Exam Type: **TE**		
Course Code	**A23PPHE205**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**NON-LINEAR OPTICS**	**4**	**0**	**0**	**4**	**25**	**75**	**100**
Prerequisite	*knowledge* of Optics and spectroscopy studied in UG							
Course Objectives	To describe the basic Physics of nonlinear optics and demonstrate different NLO phenomena							
	To analyze various types of nonlinearities in optics and its applications.							
	To study about third order nonlinearities and Kerr effect.							
	To understand the different kinds of scattering processes							
	To understand the stimulated scattering process							

Course Outcomes	***On completion of the course, the students will be able to***		BT Mapping (Highest Level)
	CO1	Understand the principles of nonlinear optics	**K3**
	CO2	Knowing the different nonlinear phenomena and its applications.	**K3**
	CO3	Apply the knowledge for third -harmonic conversion and evaluate nonlinear susceptibility of materials	**K3**
	CO4	Explore about Raman scattering process and its applications.	**K3**
	CO5	Gain the knowledge about the scattering by Raman effect	**K3**

UNIT-I	**INTRODUCTION TO NONLINEAR OPTICS**	**Periods: 12**
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 – bistability – self focusing.		**CO1**
UNIT - II	**NONLINEAR PROCESSES**	**Periods: 12**
Propagation of Electromagnetic Waves in Nonlinear medium, Self Focusing, Phase matching condition, Fiber Lasers, Stimulated Raman Scattering and Raman Lasers, CARS, Saturation and Two photon Absorptions.		**CO2**
UNIT - III	**THIRD ORDER NONLINEARITIES**	**Periods: 12**
Two photon process – Theory and experiment – Three photon process Parametric generation of light – Oscillator – Amplifier – Stimulated Raman scattering – Intensity dependent refractive index optical Kerr effect – photorefractive, electron optic effects.		**CO3**
UNIT - IV	**MULTIPHOTON PROCESSES**	**Periods: 12**
Electro-optic effects – Electro-optic modulators - Photorefractive effect - Two beam coupling in Photorefractive materials – Four wave mixing in Photorefractive materials.		**CO4**
UNIT - V	**STIMULATED SCATTERING PROCESSES**	**Periods: 12**
Stimulated scattering processes – Stimulated Brillouin scattering – Phase conjugation – Spontaneous Raman effect – Stimulated Raman Scattering – Stokes – Anti-Stokes Coupling in SRS – Stimulated Rayleigh.		**CO5**

Lecture Periods: 60 **Tutorial Periods: 0** **Practical Periods: -** **Total Periods : 60**

Text Books

1. Robert W. Boyd, Non-linear Optics, Academic Press, London, 5th Edition, 2008.
2. A. Yariv, Opto Electronics, John Wiley and Sons, New York,3rd Edition, 1990.
3. B.B. Laud, Lasers and Nonlinear Optics,New Age International Pvt. Ltd., New Delhi, 3rd Edition, 2011.

Reference Books

1. P.N.Butcher and D.Cotter, The Elements of Nonlinear Optics, CambridgeUniv. Press, New York, 1990.
2. YVGS Murthi and C. Vijayan, Essentials of Nonlinear Optics, Ane/Athena Books 1st Edition, 2014.
3. Y.R. Shen, The Principles of Nonlinear Optics, Wiley & Sons, New Jersey, 2003.

Web References

1. https://onlinelibrary.wiley.com/doi/10.1002/9781118902332.refs.
2.https://www.polytechnique.edu/teaching-learning/en/catalog/online-course/nonlinear-optics
3. https://spie.org/education/courses/coursedetail/SC047?f=InCompany

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS	Programme: **M. Sc. Physics**						
Semester	II	Course Category Code: DSE				End Semester Exam Type: **TE**		
Course Code	**A23PPHE206**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**Microprocessor And Microcontroller**	**4**	**0**	**0**	**4**	**25**	**75**	**100**
Prerequisite	*knowledge* of basic electronic principles studied in UG							
Course Objectives	To learn the architecture of 8085 microprocessor and its programming.							
	To study the architecture of 8086 microprocessor.							
	To familiarize the architecture of 8051 microcontroller and its programming.							
	To study the interfacing devices of microprocessor 8085.							
	To learn the concepts by using microprocessor							

Course Outcomes	***On completion of the course, the students will be able to***	BT Mapping (Highest Level)
	CO1 Describe basic concept and architecture of 8085 microprocessor.	**K3**
	CO2 Learn the architecture of 8086 microprocessor.	**K3**
	CO3 Understand the architecture of 8051 microcontroller and develop assembly language programs.	**K3**
	CO4 Discuss concept of interfacing in microprocessor 8085.	**K3**
	CO5 Understand the concepts of assembling language programming	**K3**

UNIT-I	**MICROPROCESSOR ARCHITECTURE (8085 AND 8086)**	**Periods: 12**
Introduction, Intel 8085: Architecture, Instruction Cycle, Timing Diagram: Op-code fetch, Memory read & Memory write – Instruction Set: Instruction and Data Format, Addressing Modes, Arithmetic, Branching, and Logical group operations - Interrupts - Architecture of 8086, Pin Configuration, register organization– Addressing Modes – Interrupts – Hardware and Software.		**CO1**
UNIT - II	**PROGRAMMING OF MICROPROCESSOR**	**Periods: 12**
Instructions for 8085 – Software development tools – Assembly language programs with data transfer, arithmetic, logical, bit level instructions and branch instructions -Interrupts and interrupt service Routines-Subroutine – Flow charting – Loops –Programming and applications: Traffic control system.		**CO2**
UNIT - III	**INTERFACING OF MICROPROCESSOR 8085**	**Periods: 12**
Basic concepts of programmable device - 8255 Programmable Peripheral Interface (PPI) – interface of ADC and DAC. 8257 Direct Memory Access (DMA) controller. Basic concepts of serial I/O and data communication – interface of 8251 Universal Synchronous Asynchronous Receiver Transmitter (USART).		**CO3**
UNIT - IV	**MICRO-CONTROLLER**	**Periods: 12**
Introduction to 8-bit micro-controller, Architecture of 8051– Hardware features of 8051 – Signal description of 8051-General Purpose and Special Function Registers- Oscillator and clock circuit–I/O Port-Memory organization and I/O addressing by 8051, Interrupts of 8051–Programming of 8051 (Simple Arithmetic and Logical programs).		**CO4**
UNIT - V	**8085 ASSEMBLY LANGUAGE PROGRAMMING**	**Periods: 12**
Instruction set: Data transfer operations - Arithmetic Operations Logical operations – Branching and machine control operations. Addressing modes. Writing assembly language programs: Looping, counting and indexing.Counters and time delays - Stack - subroutine.		**CO5**

Lecture Periods: 60 **Tutorial Periods: 0** **Practical Periods: -** **Total Periods : 60**

Text Books

1. Douglas V. Hall, Microprocessor interfacing, Programming and Hardware, Tata McGraw Hill, 2005.
2. V. Vijayendran, Fundamentals of Microprocessor-8085, S. Viswanathan Pvt. Lmt. 3rd Edition, 2005.
3. Kenneth J.Ayala, The 8051 Microcontroller – Architecture, Programming and Applications, Penram International Publishing (India) Pvt. Ltd, 2nd Edition, 1996.
4. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with 8085/8080, New Age International 6th Edition, 2013.

Reference Books

1. B.B. Brey, The Intel Microprocessors 8086/8088, 80186, 80286, 80386 and 80486, Prentice-Hall of India, New Delhi, 3rd Edition, 1995.
2. J. Uffrenbeck, The 8086/8088, Family-Design, Programming and interfacing, software, hardware and applications, Prentice-Hall of India, New Delhi, 1994.
3. A.NagoorKani, Microprocessor and its applications, 1st Edition, RBA Pub., Chennai.
4. Muhammad Ali Mazidi, Janice Mazidi, The 8051 Microcontroller and Embedded systems, Pearson Education, 2nd Edition, 2005.

Web References

1. https://www.javatpoint.com/microprocessor-introduction
2. https://www.tutorialspoint.com/microprocessor/microprocessor_overview
3. https://gradeup.co/8085-microprocessor-i-98c6e670-c040-11e5-90e9-37a8af81db5e

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	II	Course Category Code: DSC				End Semester Exam Type: **PE**		
Course Code	**A23PPHL203**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**GENERAL PRACTICAL – II``**	**0**	**0**	**4**	**2**	**50**	**50**	**100**
Prerequisite	Basics of Physics experiments							
Course Objectives	To Acquire strong laboratory skills.							
	To provide a practical understanding of some of the concepts learnt in the theory course on Physics.							
	To evaluate the process and outcomes of an experiment quantitatively and qualitatively.							
	To inculcate strong laboratory skills.							
	To make the students gain a practical knowledge in the basics of Physics.							

Course Outcomes	***On completion of the course, the students will be able to***	BT Mapping (Highest Level)
	CO1 Understand the concepts behind various physics experiments.	**K3**
	CO2 Understand the basics of experimental physics	**K3**
	CO3 Explore the concepts involved in the thermodynamics, heat and modern optics	**K3**
	CO4 Create the knowledge of theories involved in physics using practical experiments	**K3**
	CO5 Enhance the skill to meet the present day requirements in industries, research fields	**K3**

(Choose any 8 experiments from the list given below)

LIST OF EXPERIMENTS

1. Determination of Young's modulus of glass by Cornus Method.
2. Determination of Young's modulus of glass plate by Elliptical fringe method.
3. Determination of wavelength of mercury lamp spectral lines using plane diffraction grating
4. Determination of charge carrier density using Hall Effect.
5. Determination of laser diffraction at a straight wire. Determination of Laser diffraction at a circular apertures and study of laser beam parameter.
6. Determination of Refractive index of liquids using He-Ne laser/diode laser.
7. Determination of beam – spot size using He-Ne laser. Determination of focal length of a given lens using He-Ne laser.
8. Determination of linear absorption of coefficients of liquid using UV-Visible absorption spectrometer.
9. B-H curve using CRO.
10. Specific charge of an electron- J.J. Thomson's method.

Lecture Periods: 0 **Tutorial Periods: 0** **Practical Periods: 30** **Total Periods : 30**

Text Books

1.C.C Ouseph, V.J.Rao and V. Vijayendran "Practical Physics"

2.M.N. Srinivasan "Practical Physics", Sultan son Pub.

3.D P Khandelwal, "Laboratory Manual of Physics" for UG classes (Vani Pub. House, New Delhi)..

Reference Books

1. V Y Rajopadhye and V L Purohit, Text book of experimental Physics
2. C.C Ouseph, V.J.Rao and V.Vijayendran "Practical Physics"

Web References
1. https://www.tvu.edu.in/wp-content/uploads/2017/06/B-Sc-Physics.pdf
2.https://www.physics.louisville.edu/cldavis/phys298/notes/torpend.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	Observation	Model Exam	Viva Voce	Attendance		
Marks	15	15	10	10	50	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	PHYSICS	Programme: **M. Sc.Physics**						
Semester	II	Course Category Code: DSC				End Semester Exam Type: **PE**		
Course Code	**A23PPHL204**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	CAM	ESE	TM
Course Name	**ELECTRONICS PRACTICAL – II**	**0**	**0**	**4**	**2**	**50**	**50**	**100**
Prerequisite	Basics of Physics experiments							

Course Objectives	To provide a practical understanding of some of the concepts learnt in the theory course on Physics.
	To evaluate the process and outcomes of an experiment quantitatively and qualitatively.
	To give hands on training in the construction of simple electronic circuits.
	To inculcate strong laboratory skills.
	To make the students gain a practical knowledge in the basics of Physics.

Course Outcomes	***On completion of the course, the students will be able to***		BT Mapping (Highest Level)
	CO1	Understand the concepts behind various physics experiments.	**K3**
	CO2	Understand the basics of experimental physics	**K3**
	CO3	Explore the concepts involved in the thermodynamics, heat and modern optics	**K3**
	CO4	Create the knowledge of theories involved in physics using practical experiments	**K3**
	CO5	Enhance the skill to meet the present-day requirements in industries, researchfields	**K3**

(Choose any 8 experiments from the list given below)

LIST OF EXPERIMENTS

1. Arithmetic operations using IC 7483.
2. Shift Register, Ring counter, Johnson counter using J-K flip flops 7476/7473.
3. Up /Down Counters using IC 7476/7473.
4. Digital to analog converter using IC 741-R/2R ladder.
5. BCD counter – decoding and display.
6. Decoders and encoders
7. Construction of two stage transistor amplifier.
8. Design of monostable multivibrator using IC 741 AND Timer 555.
9. Design of Schmidt Trigger using IC 741 and Timer 555.
10. Construction of Colpitts and Hartley oscillators using Transistor.

Lecture Periods: 0 **Tutorial Periods: 0** **Practical Periods: 30** **Total Periods : 30**

Text Books

1. C.C Ouseph, V.J.Rao and V. Vijayendran “Practical Physics”

2.M.N. Srinivasan “Practical Physics”, Sultan son Pub.

3.D P Khandelwal, “Laboratory Manual of Physics” for UG classes (Vani Pub. House, New Delhi)..

Reference Books

1.V Y Rajopadhye and V L Purohit, Text book of experimental Physics

2.C.C Ouseph, V.J.Rao and V.Vijayendran “Practical Physics”

Web References

1. https://www.tvu.edu.in/wp-content/uploads/2017/06/B-Sc-Physics.pdf
2. https://www.physics.louisville.edu/cldavis/phys298/notes/torpend.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	3	2	3
2	3	3	3	3	3	3	2	3
3	3	3	3	3	3	3	2	3
4	3	3	3	1	3	3	3	3
5	3	2	2	2	3	3	3	3

Correlation Level: 1: Low, 2: Moderate, 3: High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	Observation	Model Exam	Viva Voce	Attendance		
Marks	15	15	10	10	50	100

Department	**Mathematics**	Programme: M.Sc. Physics						
Semester	**Second Semester**	Course Category Code: **SEC**			*End Semester Exam Type:			
Course Code	**A23PMAS201**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**QUANTITATIVE REASONING AND RESEARCH APTITUDE**	**2**	**0**	**0**	**2**	**100**	**-**	**100**
Prerequisite	Basic mathematical and reasoning knowledge							
Course Objectives	• To know the simple interest and compound interest. • To know the Permutation and Combination. • To gain the knowledge of Time and Work Problems. • To gain the knowledge the of percentage, profit and loss. • To know the concept of coding and decoding.							

Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Learn about the simple interest and compound interest.	**K3**
	CO2 Understand the Problems on Trains.	**K3**
	CO3 Solve the Time and Distance Problems.	**K3**
	CO4 Know about the ratio and proportion	**K3**
	CO5 Understand the Alphanumeric series.	**K3**

UNIT-I	**Periods: 6**
Simple interest and Compound interest.	CO1
UNIT-II	**Periods: 6**
Permutations and Combinations - Problems on Trains	**CO2**
UNIT-III	**Periods: 6**
Time and Work Problems - Time and Distance Problems.	**CO3**
UNIT-IV	**Periods: 6**
Percentage-Profit and Loss - Ratio and Proportion	**CO4**
UNIT-V .	**Periods: 6**
Input and Output – Coding and Decoding – Alphanumeric series – Ranking	**CO5**

Lecture Periods: 30	**Tutorial Periods:-**	**Practical Periods:-**	**Total Periods:30**

Reference Books

1. Quantitative Aptitude for competitive Examination-AbhijitGuha-TMH.
2. Mathematics for life-M. Immaclate-Nanjil offsetPrinters.
3. Objective Arithmetic's-R. S-Aggarwal-S. Chand &Co.

Text Books

1. Quantitative Aptitude for competitive Examination, R.S. Aggarwal. S. Chand and company Ltd,152, Anna salai, Chennai.(2001)
2. Quantitative Aptitude and Reasoning Praveen PHIP.Ltd.
3. Scope and treatment as in "Quantitative Aptitude" by R.S. Aggarwal. S. Chand and company Ltd.,Ram Nagar, New Delhi(2007).

Web References

1. https://www.careerbless.com/aptitude/qa/home.php
2. https://www.javatpoint.com/aptitude/quantitative
3. https://www.letsstudytogether.co/quantitative-aptitude-topic-wise-questions-and-answers-pdf-download/

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	CAT 3	Assignment*	Attendance		
Marks	70			20	10	-	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus