ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE

(AUTONOMOUS)

CUDDALORE-1

PG & RESEARCH DEPARTMENT OF PHYSICS

M.Sc.,(Physics)

SYLLABUS 2020-2021

P.G. and Research Department of Physics
M.Sc., Physics
Curriculum Template

First Year

Sem	Code	Title	Hours/Week	Credits
I	18PPH11	Classical Mechanics	5	4
	18PPH12	Mathematical Physics I	5	4
	18PPH13	Electromagnetic Theory	5	4
	18EPPH14	Electronic Devices & Applications (Elective – I)	5	3
	18EPP14A	Laser Physics (Elective – I)	5	3
	18PPHP11	General Practical-I	4	4
	18PPHP12	Electronics Practical-I	4	4
		Skill / Library	2	
	Total		30	23
II	18PPH21	Statistical Mechanics	5	4
	18PPH22	Mathematical Physics II	5	4
	18PPH23	Quantum Mechanics-I	5	4
	18EPPH24	Physics of Nanomaterials (Elective –II)	5	3
	18EPPH24	Medical Physics (Elective –II)	5	3
	18PPHP21	General Practical-II	4	4
	18PPHP22	Electronics Practical-II	4	4
		Skill / Library	2	
	Total		30	23

Second Year

Sem	Code	Title	Hours/Week	Credits
III	18PPH31	Molecular Physics	5	4
	18PPH32	Quantum Mechanics – II	5	4
	18PPH33	Condensed Matter Physics	5	4
	18EPPH34	Microprocessor 8086 and microcontroller(Elective –III)	5	3
	18EPP34A	Communication Physics(Elective –III)	5	3
	18PPHP31	General Practical-III	4	4
	18PPHP32	Microprocessor Practical-III	4	4
	ECHR901S	Human Rights	2	1
	Total		30	24
IV	18PPH41	Nuclear & Particle Physics	5	4
	18PPH42	Research methodology, computation methods &Programming	5	4
	EPPH1014	Materials science (Elective –IV)	5	4
	18EPPH43	Electronic instrumentation(Elective –IV)	5	4
	18EPP43A	Astronomy and astrophysics(Elective –IV)	5	4
	18PPH44	Project	8	6
	18PPH45	Guide Paper	3	2
	18PPH46	Skill Based Subject (Scientific Analysis)	4	2
	Total		30	20

I – M.Sc SEM- I	Course Code: 18PPH11	Title of the Paper: CLASSICAL MECHANICS	HRS/WK 5	CREDITS 4

Course Outcomes	
CO1	To acquire knowledge of Lagrangian formulations
CO2	Central Force Motion And Small Oscillations
CO3	To understand the concepts of Hamiltonian formulations.
CO4	To study dynamics of rigid bodies
CO5	To understand the concepts of relativistic mechanics

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	Programme Outcomes POs					Programme Specific Outcomes PSOs						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	3.5	2.5	4.1	3.5	3.5	2.5	3	3.5	4.2	3.2	3.2	3.33
CO2	3.6	3.2	3.6	3	3.5	2.8	4.1	3.6	3.7	2.3	3.5	3.35
CO3	3.5	4.3	3.5	2.8	3	3.6	3.5	3.5	3.7	4.2	3.3	3.53
CO4	3.2	3.6	3	4	3	3.5	3.4	2.8	3.4	3.5	3.6	3.36
CO5	4	3.5	3.5	3.2	3.6	2.5	3.5	3.2	4	3.2	3.5	3.42
Mean Overall Score												3.40

Result: The Score for this course is High

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

Value Scaling

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

UNIT-I: PRINCIPLES AND LAGRANGIAN FORMULATION (15 Hours)

Mechanics of a particle and system of particles – conservation laws – constraints - generalized co-ordinates – D'Alembert's principle and Lagrange's equations and Hamilton's principle - Lagrangian equation of motion from Hamilton's principle – conservation theorems and symmetry properties-Invariance &Noether's theorem (without proof)-Applications.

UNIT-II: CENTRAL FORCE MOTION AND SMALL OSCILLATIONS (15 Hours)

Reduction of two body problem into one body problem-orbits of central body problem – Kepler problem – RungeLenz vector – Rutherford Scattering cross section- Centre of Mass and Laboratory frames of references - Theory of small oscillations – frequencies of free vibration and normal -coordinates – Linear Di & Tri atomic molecules (HCl, NO_2, CO_2) – a spring pendulum – double pendulum.

UNIT-III: HAMILTONIAN FORMULATIONS (15 Hours)

Hamilton's canonical equation – proof of principle of least action – general equations of canonical transformations -Cyclic Co-ordinates- Hamilton - Jacobi differential equation – Legrange brackets and Poisson brackets – Action angle variables – the Kepler problem in action angle variable.

UNIT-IV: RIGID BODY DYNAMICS (15 Hours)

Angular momentum – rotational kinetic energy and moment inertia of a rigid body – Euler's angle – moments and products of inertia – Eulers' equation – Motion of a symmetrical top under the action of gravity.

UNIT-V: RELATIVISTIC MECHANICS (15 Hours)

Lorentz transformations – Lorentz transformations in real four dimensional spaces – covariant four dimensional formulations – force and energy equations in relativistic mechanics – Lagrangian and Hamiltonian formulation of relativistic mechanics.

TEXT BOOKS:-

1. Rana.N.C&Joag, P.S, Classical Mechanics, Tata McGraw Hill Education. 2015
2. Herbert Goldstein, Classical Mechanics, Narosa Publications.2001
3. Louis N. Hand, Janet D. Finch, Analytical Mechanics, Cambridge University Press.1998
4. David Morin, Introduction to Classical Mechanics, 2008
5. Thornton Marion, Classical Dynamics of Particles and Systems 5th Edition.2004

REFERENCE BOOKS:-

1. Bhatia V.B, Classical Mechanics, Tamil Nadu Book House 2001
2. C.R.Mondal, Classical Mechanics, PHI Learning Private Limited.2008
3. R. Douglas Gregory, Classical Mechanics, Cambridge University Press.2006
4. Theory & Problems Of Theoretical Mechanics (Schaum's Outline Series) (SI Units)1967
5. Schaum's Outline of Lagrangian Dynamics (Schaum's Outline Series)2015
6. Gupta Kumar Sharma, Classical Mechanics.2010

I – M.Sc SEM- I	Course Code: 18PPH12	Title of the Paper: Mathematical Physics I	HRS/WK 5	CREDITS 4

Course Outcomes	
CO1	Give the basic knowledge of vector spaces
CO2	Understand the concepts Fourier and Laplace Transforms
CO3	Learn about the fourier series and laplace transforms
CO4	Study the complex variables
CO5	Understand the concepts of special functions

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	Programme Outcomes POs					Programme Specific Outcomes PSOs						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	3.5	2	4.1	3.4	3.5	2.5	3	3.4	4	3.2	3.2	3.25
CO2	3.4	3	3.6	3	3.5	2.8	4	3.6	3.7	2.1	3.5	3.29
CO3	3.5	4	3.5	2.8	3	3	3.5	3.5	3.4	4	3.3	3.40
CO4	3.4	3.6	3	4.2	3.7	3.5	3.4	2.8	3.4	3.7	3.6	3.48
CO5	4.3	3.6	3.5	3.2	3.6	2.8	3.5	3.2	4.2	3.5	3.7	3.55
Mean Overall Score												3.39

Result: The Score for this course is High

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ PSOs}$

Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

UNIT-I: LINEAR ALGEBRA (15 Hours)

Physical examples of Vectors and Matrices - Linear equations - Linear combinations - linear independence - Vector spaces: real and complex - subspace, basis, dimension, intersection - Linear transformations - Inner product, norm, right triangles - Orthogonality, orthogonal complement - Cauchy-Schwarz inequality - Orthonormal basis - Gram-Schmidt orthogonalization - Transformation of vectors and matrices under change of basis - Similarity or general linear transformations - completeness relation

UNIT-II: COMPLEX VARIABLES (15 Hours)

Complex variable theory - Single and multivalued functions - The Cauchy-Riemann differential equations - Cauchy's integral theorem and integral formula - Residue and Cauchy's residue theorem - Lioville's theorem – Applications of the evaluation of definite integrals.

UNIT-III: FOURIER SERIES AND LAPLACE TRANSFORMS (15 Hours)

Fourier series - arbitrary period – Dirichlet conditions – Half-wave expansions – Parseval's theorem - Fourier integral and transforms - Fourier Sine and Cosine transformation - Laplace transform - first and second shifting theorems - Inverse Laplace transforms - Laplace transformation for solving differential equations of a function.

UNIT-IV: DIFFERENTIAL EQUATIONS (15 Hours)

Linear ordinary differential equations of first order and second order – Degree of ordinary differential equations – Linear differential equation - General solution and particular solution – Method of solution – Higher order differential equation – Homogeneous linear differential equation – Linear differential equation of second order.

UNIT-V: SPECIAL FUNCTIONS (15 Hours)

Gamma and beta functions - Legendre, Bessel, Hermite and Laguerre equations - Generating functions - Series solutions and recurrence relations for Legendre, Bessel, Hermite and Laguerre equations - Physical applications.

TEXT BOOKS:-

1. TulsiDass, S. K. Sharma, Mathematical Physics.1998
2. Sathyaprakash. R, *Mathematical Physics*.2014
3. Arfken G, *Mathematical Methods for Physics*2012
4. Joshi A.W, *Matrices and Tensors for Physicists*. 1995
5. Rainville E.D, *Special Functions*. 1960
6. Bell W.W, *Special Functions*. 1968
7. Spiegel, *Fourier Laplace Transforms*, Schaum's Outline Series.2014
8. Complex Variables - Spiegel, Schaum's Outline Series 2009

REFERENCE BOOKS:-

1. Kreyszig E, *Advanced Engineering Mathematics.2011*
2. Reily K.F Hobson M.P. and Bence S.J, *Mathematical Methods for Physicists and Engineers.2006*
3. Howard Anton, *Elementary Linear Algebra,* John Wiley Sons2000
4. Engineering Mathematics-series, Dr. M. K. Venkataraman- The National publishing company-Madras.1992

I-MSC SEM-I	Course Code: 18PPH13	Title of the Paper: Electromagnetic Theory	HRS/WK 5	CREDITS 4

Course Outcomes	
CO1	Study electromagnetic waves
CO2	Understand the concepts of reflection and transmission of EM waves
CO3	Acquire knowledge of wave guides and waves
CO4	Study about antenna and wave propagation
CO5	Understand the concepts relativistic electrodynamics

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	Programme Outcomes POs					Programme Specific Outcomes PSOs						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	3.1	3.8	4.2	3.5	3.5	2.8	3.5	3.3	4.2	3	3.5	3.49
CO2	3.8	3.2	3.6	3	3.5	3.6	4.3	3.5	3.5	2.6	3.7	3.48
CO3	3.5	4.2	3.2	2.5	3	3.7	3.2	3.5	3.5	3	3.4	3.33
CO4	3	3.8	3	3.7	3	4	3	2.9	3.5	3.2	3.5	3.32
CO5	4.1	2.5	3.5	3	3.5	2.2	3.5	3.2	3	3.1	2.5	3.1
Mean Overall Score												3.34

Result: The Score for this course is High

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

Value Scaling

Mean Score of COs= $\frac{\text{Total Values}}{\text{Total No.of POs \& [illegible]}}$

Mean Overall Score of COs= $\frac{\text{Total Mean Scores}}{\text{Total No.of COs}}$

UNIT I: Electrostatics **(15 Hours)**

Laplace and Poisson equations – Boundary value problems - boundary conditions and uniqueness theorem – Laplace equation in three dimensions– Solution in Cartesian and spherical polar coordinates – Examples of solutions for boundary value problems - Polarization and displacement vectors - Boundary conditions - Dielectric sphere in a uniform field – Molecular polarisability and electrical susceptibility –Langevin Theory of Polar molecules - Electrostatic energy in the presence of dielectric – Multipole expansion.

UNIT II: Magnetostatics **(15 Hours)**

Biot-Savart Law - Ampere's circuital law - Magnetic vector potential and magnetic field of a localised current distribution - Magnetic moment, force and torque on a current distribution in an external field - Magnetostatic energy - Magnetic induction and magnetic field in macroscopic media - Boundary conditions - Uniformly magnetized sphere.

UNIT III: Maxwell Equations **(15 Hours)**

Faraday's laws of Induction - Maxwell's displacement current - Maxwell's equations – free space and linear isotropic media - Vector and scalar potentials - Gauge invariance - Wave equation and plane wave solution- Coulomb and Lorentz gauges - Energy and momentum of the field - Poynting's theorem - Lorentz force - Conservation laws for a system of charges and electromagnetic fields.

UNIT IV: Electromagnetic Waves **(15 Hours)**

Plane waves in non-conducting media - Linear and circular polarization, reflection and refraction at a plane interface- Fresnel’s law, interference, coherence and diffraction - Waves in a conducting medium - Propagation of waves in a rectangular wave guide - Inhomogeneous wave equation and retarded potentials - Radiation from a localized source - Oscillating electric dipole.

UNIT-V RELATIVISTIC ELECTRODYNAMICS **(15 Hours)**

Four vector-Lorentz transformation of space and time in four vector form. - Transformation of electromagnetic potentials - Maxwell’s equation in covariant tensor form

TEXT BOOKS:-

1. David. I. Griffiths, *Introduction to electrodynamics*, Prentice Hall of India2012
2. Sadiku, Elements of Electromagnetics 2014
3. Narayana Rao, *Basic electromagnetics with applications,* Prentice Hall 1991
4. Kraus, *Introduction to electrodynamics*, Prentice Hall of India.2013
5. Chakraborty B, *Principles of Electrodynamics*, Books and allied Kolkata.2002.
6. Landah&Lifschitz, *Electrodynamics of continuous media.*1960
7. SatyaPrakash, *Electromagnetic Theory & Electrodynamics*, ArihantPublishers, 2012.

REFERENCE BOOKS:-

1. Sengupta P, *Classical Electrodynamics*, New Age International publishers.2015
2. Andrew Zangwill, *Modern Electrodynamics*.2013
3. AnupamGarg, *Classical Electromagnetism in a Nutshell*. 2012

I – M.Sc SEM-I	Course Code: 18EPPH14	Title of the Paper: ELECTRONIC DEVICES & APPLICATIONS	HRS/WK 5	CREDITS 3

Course Outcomes	
CO1	Acquire knowledge of PN junction diode and special diodes
CO2	Understand the concepts of various semiconductor transistors & devices
CO3	Study microwave devices
CO4	Understand the concepts Op-amps and its applications
CO5	Apply the knowledge of Oscilloscope and other measuring instruments

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	**Programme Outcomes POs**					**Programme Specific Outcomes PSOs**						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	3	3.8	4	3.5	3	2.6	3.4	3	4	3	3.2	3.31
CO2	3.5	3	3.2	3	3	3.6	4	3.4	3	2.6	3.5	3.25
CO3	3.7	4.1	3.2	2.6	3.2	3.2	3	3.5	3.8	3.5	3.3	3.37
CO4	3.4	3.8	3	4.3	3.4	4	3.5	2.8	3.5	3	3.8	3.5
CO5	4.2	3.5	3.5	3.2	3.6	2.7	3.8	3	4	3.7	3.5	3.51
Mean Overall Score												3.39

Result: The Score for this course is High

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ PSOs}$	Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

UNIT-I: FABRICATION OF IC AND LOGIC FAMILIES (15 Hours)

Fabrication of IC - Monolithic integrated circuit fabrication - IC pressure transducers -Monolithic RMS - Voltage measuring device - Monolithic voltage regulators - Integrated circuit multipliers - Integrated circuit logic - Schottky TTL - ECL - I2L - P and N-MOS Logic - CMOS Logic- Tristate logiccircuits – PLA, PLC and PLD.

UNIT-II: OPTO ELECTRONIC DEVICES (15 Hours)

Light sources and Displays - Light emitting diodes - Surface emitting LED - Edge Emitting LED -Seven segment display - LDR - Diode lasers - Photo detectors - Basic parameters - Photodiodes - p-i-n Photo diode - Solar cells - Photo transistors - IR and UV detectors.

UNIT-III: NEGATIVE CONDUCTANCE MICROWAVE DEVICES (15 Hours)

Transit time devices: IMPATT diode – QWITT diode – TRAPATT diode - Gunn diode - The transferred electron mechanism – Formation and drift of space charge domains - modes of operation in resonance circuit - Fabrication and applications.

UNIT-IV: OSCILLOSCOPE AND OTHER MEASURING INSTRUMENTS (15 Hours)

Introduction - Cathode Ray Tube—Theory and Construction - Cathode Ray Oscilloscope Operation - Voltage Sweep Operation - Synchronization and Triggering - Multitrace Operation - Measurement Using Calibrated CRO Scales - Special CRO Features - Signal Generators.

UNIT-V: COMMUNICATION ELECTRONICS (15 hours)

Local Loop, PSTN, ISDN, digital exchanges, satellite communicationand VSAT, W ireless communication technologies: spread spectrumtechniques, OFDM, Cellular phones, 3G wireless, IP telephony,Bluetooth, IrDA, CDMA.

TEXT BOOKS:-

1. SZE SM, 1985, *Semiconductor Devices – Physics and Technology*, Wiley.
2. Streetman B.G., *Solid State Electronic Devices,*(4th Edition), Prentice Hall of India 1997
3. Milman and Halkins, 1993, *Integrated Electronics*, Tata McGraw hill.
4. Gayakwad R.A., *OP AMPS and Linear Integrated Circuits,* (3rdEdn), Prentice Hall of India.2015
5. Liano S.L., *Microwave Devices and Circuits*, Prentice Hall of India.1990
6. Taub and Shilling, 1983, Digital Integrated Electronics, McGraw-Hill, New Delhi.
7. J. Millman, 1979, Digital and Analog Circuits and Systems, McGraw-Hill, London.
8. George Kennedy, 1987, Electronic communication systems 3rd Edition, McGraw-Hill, London.
9. Electronic Communication systems – Roy Blaks, Thomson –Delmar 2002.
10. Electronic Communication – robber t J .Schoenbeck, UBS 2002.

REFERENCE BOOKS:-

1. Tyagi M.S., *Introduction to Semiconductor devices*, John Wiley & Sons.2015
2. Joseph Lindemeyer and Charles Y. Wrigley, 1965, *Fundamentals of semiconductor Devices,*D.VanNostrand Company.
3. Gutpa Y.C., *Microwave Electronics,* John Wiley.1999
4. R.F. Coughlin and F.F, Driscol, 1996, Op-Amp and linear integrated circuits, Prentice Hall of India, New Delhi.
5. M.S.Tyagi, Introduction to Semiconductor Devices, Wiley, New York.1991
6. P. Bhattacharya, 2002, Semiconductor Optoelectronic Devices, 2nd Edition, Prentice-Hall of India, New Delhi.
7. Deboo/ Burrous, 1985, Integrated circuits and semiconductor Devices – Theory and application, McGraw-Hill, New Delhi.

8. D. Roy Choudhury, 1991, Linear integrated circuits, Wiley Eastern, New Delhi.
9. RamakantGaekwad, 1981, Operational amplifiers, Wiley Eastern, New Delhi.
10. Modern Electronic Communications – Gray M. Miller Jeffrey Beasley, PHI, 2003.
11. Electronic Communication–Taub, Schilling, 1993 McGraw Hill.
12. Electronic Communication – Carlson Published 2002 McGraw-Hill.
13. Electronic communication systems, Kennedy, TMH.
14. Electronic communication, Roody, Coolean, Prentis Hall

I M.Sc SEM-1	Course Code: 18EPP14A	Title of the Paper: Laser Physics	HRS/WK 5	CREDITS 3

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand the basic principles of laser action
CO2	Learn the characteristics of laser
CO3	Provide solutions to various problems related to laser systems
CO4	Apply the laser spectroscopic techniques in various applications
CO5	Study the features and parameters of quantum laser

Mapping of course outcomes with the program specific outcomes

Course Outcomes Cos	**Programme Outcomes POs**					**Programme Specific Outcomes PSOs**						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	3	3	3	3	2	3	3	3	3	3	3	2.909
CO2	3	3	3	3	3	3	3	3	3	4	3	3.090
CO3	3	4	3	3	2	4	3	3	4	3	3	3.181
CO4	4	3	3	3	3	3	4	4	3	3	3	3.272
CO5	4	4	4	3	2	3	3	4	3	4	3	3.363
Mean Overall Score												3.163

Result: The Score for this course is HIGH

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ COs}$

Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

UNIT-I PRINCIPLES OF LASER ACTION (15 Hours)

Einstein's theory - Interaction of radiation with matter - Theory of some simple processes.

UNIT-II LASER CHARACTERISTICS (15 Hours)

Gaussian beam and its properties - Stable two Minor optical resonators, Longitudinal and Transverse Modes of Laser cavity- Mode selection-gain in a Regenerative Laser cavity-Threshold for 3 and 4 level laser systems- Mode locking pulse shortening-Pico second &femto second operation- Spectral narrowing and stabilization.

UNIT-III LASER SYSTEMS (15 Hours)

Laser systems involving low density gain media- Nitrogen Laser, Carbondioxide Laser and Excimer Laser. Laser systems involving high density gain media- Ruby Laser, Nd-YAG laser, Semiconductor laser, Diode Pumped solid state laser, Dye laser, High power semiconductor diode laser systems.

UNIT-IV LASER SPECTROSCOPIC TECHNIQUES AND OTHER APPLICATIONS(15 Hours)

Laser fluorescence and Raman scattering and their use in Pollution studies, Nonlinear interaction of light with matter, laser induced multi photon processes and their applications, Ultra high resolution spectroscopy with laser and its applications, Propagation of light in a medium with variable refractive index, optical Fibers. Light wave communication. Qualitative treatment of medical and engineering applications of Lasers.

UNIT-V QUANTUM TREATMENT (15 Hours)

Einstein coefficients-Momentum transfer- life time- Possibility of amplification. Quantization of the field- Zero point energy, Coherence and monochromaticity, Kinetics of Optical absorption- Quantum mechanical treatment of line broadening mechanism- Doppler broadening.

TEXT BOOKS:-

1. OrazioSvelto, *Principles of Lasers*1991
2. William t. Silfvast, *Laser Fundamentals 2004*
3. B.B. Laud, *Lasers and Non-linear Optics1992*

REFERENCE BOOKS:-

1. Yariv, Optical Electronics 2006
2. Demtroder, Laser and Spectroscopy 1973
3. Latekhor, Non-linear Laser Spectroscopy 1972

I – M.Sc (Physics)	GENERAL PRACTICAL – I	18PPHP11
SEMESTER - I		HRS/WK - 4
CORE		CREDIT - 4

Any 7 out of 10

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.

I – M.Sc (Physics)	ELECTRONICS PRACTICAL – I	18PPHP12
SEMESTER - I		HRS/WK - 4
CORE		CREDIT - 4

Any 7 out of 11

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 logic gates.
5. Design full adder and full subtractor and verify its truth table using logic gates.
6. Construct an astablemultivibrator using transistor and to determine the frequency of oscillation.
7. Design an astablemultivibrator 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.
11. Application of op-amp as an integrator/differentiator amplifier.

I – M.Sc SEM-II	Course Code: 18PPH21	Title of the Paper: STATISTICAL MECHANICS	HRS/WK 5	CREDITS 4

Course Outcomes	
CO1	Study the nature of statistical mechanics
CO2	Understand the concepts of various ensembles
CO3	Study statistics of systems of independent particles
CO4	Understand the concepts quantum statistics
CO5	Understand the fluctuations and Transport Properties of materials

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	**Programme Outcomes POs**					**Programme Specific Outcomes PSOs**						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	3.5	3	3	3.5	3.5	4	3.5	3	3.5	3.5	3.5	3.41
CO2	3.5	3	4	3.5	3.5	4	3.5	3.5	2.5	4	3.5	3.50
CO3	3.5	3.5	3	3	3.5	3.5	4	3.5	4	3.5	3.5	3.50
CO4	4	3.5	2.5	3	3.5	3.5	3.5	4	3.5	4	4	3.55
CO5	3.5	4	3.5	4	4	3.5	3.5	4	3.5	4	3	3.68
Mean Overall Score												3.53

Result: The Score for this course is High

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ PSOs}$	Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

UNIT-I: FOUNDATIONS OF STATISTICAL MECHANICS (15 Hours)

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.

UNIT-II: PARTITION FUNCTION (15 Hours)

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 C_V.

UNIT-III: STATISTICS OF SYSTEMS OF INDEPENDENT PARTICLES (15 Hours)

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.

UNIT-IV: QUANTUM STATISTICS (15 Hours)

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.

UNIT-V: FLUCTUATIONS AND TRANSPORT PROPERTIES (15 Hours)

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.

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, PragathiPrakasham 1995

REFERENCE BOOKS:-

1. Landau and Lifshitz,Statistical Physics 1980
2. Ralph Baierlein, Thermal Physics, Cambridge University Press 1999
3. Gupta M. C, Statistical Thermodynamics, New Age International Publishers 1995
4. Gopal ESR, *Statistical Mechanics & Properties of Matter,* The Macmillan Co. of India Ltd. 1976
5. Laud B.B, *Fundamentals of statistical Mechanics,* New Age International Publishers 1951

- For Question paper pattern refer pg. no. 113

I – M.Sc SEM-II	Course Code: 18PPH22	Title of the Paper: MATHEMATICAL PHYSICS - II	HRS/WK 5	CREDITS 4

Course Outcomes: At the end of the course, the student will be able to

CO1	To give the basic knowledge of tensors
CO2	Get the acquire knowledge of group theory
CO3	understand the concepts partial differential equation
CO4	study numerical analysis
CO5	understand the concepts of probability and statistics

Mapping of course outcomes with the program specific outcomes

Course Outcomes Cos	Programme Outcomes POs					Programme Specific Outcomes PSOs						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	5	5	5	5	4	5	5	5	5	5	4	4.818
CO2	5	5	5	5	4	5	5	5	5	5	4	4.818
CO3	5	5	5	5	4	5	5	5	5	5	4	4.818
CO4	5	5	5	5	4	5	5	5	5	5	4	4.818
CO5	5	5	5	5	4	5	5	5	5	5	4	4.818
Mean Overall Score												4.818

Result: The Score for this course is VERY HIGH

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ PSOs}$	Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

UNIT-I: TENSORS (15 Hours)

Tensors Under Generalized Coordinate Transformations - Definition of tensor; rank, symmetric tensors, contraction, quotient rule; tensors with zero components, tensor equations, metric tensors and their determinants; pseudo tensors; transformation of $\varepsilon^{ijk}/(g)^{1/2}$

UNIT-II : GROUP THEORY (15 Hours)

Definition of groups, subgroups and conjugate classes - Symmetry elements, Transformation, Matrix representation - Point groups - representation of a group - Reducible and irreducible representations - Orthogonality theorem - character of a representation - character Table C2v and C3v – Application to IR and Raman active vibrations of XY3 molecules - Symmetry rotations SO(2) and SO(3) groups - Symmetry Unitary SU(2) and SU(3) groups.

UNIT-III: PARTIAL DIFFERENTIAL EQUATION (15 Hours)

Formation of Partial differential equations – elimination of arbitrary constants – elimination of arbitrary functions –Singular integral – General integral - Standard types of first order equations – Linear Partial Differential equation of Second and higher order with constant coefficients. One dimensional wave equations, heat equation.

UNIT-IV: NUMERICAL ANALYSIS (15 Hours)

Eigen values and eigenvectors of matrices, power and Jacobi methodFinite Differences, interpolation with equally spaced and unevenly spaced point,Curve fitting Polynomial least squares, Numerical solution of ordinary differentialequation, Euler &Runga-Kutta method, Numerical integration, Trapezoidal rule,Simpson’s method.

UNIT-V: PROBABILITY AND STATISTICS. (15 Hours)

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.

TEXT BOOKS:-

1. S.Narayanan and T.K. ManicavachagomPillay , Calculus III 1979
2. Transforms and Partial differential equations by Dr. A. Singaravelu
3. Introductory course in Differential equations , D.A.Murray, Orient Longman (1967)
4. Advance Engineering Mathematics , Erwin Kreyzsig, Wiley India Edition (2010)
5. Engineering Mathematics , M.K.Venkataraman, National Publications , Chennai (2009)
6. Fundamentals of Mathematical Statistics by S.C.Gupta, V.K.Kapoor, Sultan Chand and Sons , 11th edition 1982
7. Statistical methods by S.P.Gupta – Sultan Chand.2011
8. Statistics (Theory and Practice) by R.S.N.Pillai& V. Bagavathy -S.Chand& Co.
9. Bansilal, Sanjay Arora and Sudha Arora (2006): Introducing Probability and Statistics, 2/e, SatyaPrakashan Publications, New Delhi.
10. F.A Cotton, Chemical Applications of Group Theory, Wiley; Third edition, 2008.
11. P K Chattopadhyay, Mathematical Physics New Age; 2 edition, 2013.

REFERENCE BOOKS:-

1. Kreyszig E, *Advanced Engineering Mathematics.2011*
2. Reily K.F Hobson M.P. and Bence S.J, Mathematical *methods 2006*

I –M. Sc SEM-II	Course Code: 18PPH23	Title of the Paper: QUANTUM MECHANICS – I	HRS/WK 5	CREDITS 4

Course Outcomes	
CO1	Study the postulates of quantum mechanics
CO2	Understand the concepts one dimensional problems
CO3	Understand the concepts of angular momentum operators & Eigen values.
CO4	Understand the various approximation methods
CO5	Acquire knowledge of relativistic quantum mechanics

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	Programme Outcomes POs					Programme Specific Outcomes PSOs						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	2.1	3.5	2.2	3.3	3.5	3.6	4.3	3.6	4.2	4.3	1.1	3.24
CO2	3.2	3.8	2.3	3.5	2.8	3.4	4.4	3.2	4.6	4.7	1.2	3.43
CO3	1.1	3.6	1.2	3.1	3.3	3.8	4.1	3.8	4.4	4.4	1.5	3.11
CO4	4.0	3.4	1.4	2.6	3.5	3.8	4.6	3.3	4.3	4.1	1.2	3.29
CO5	2.4	4.0	1.3	3.7	3.6	4.0	4.4	4.3	4.3	4.0	1.1	3.37
Mean Overall Score												3.304

Result: The Score for this course is High

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ PSOs}$

Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

UNIT-I: BASIC FORMALISM (15 Hours)

Postulates of quantum mechanics - Equation of continuity – Erhenfest's theorem- Operator formalism - Linear operators, self adjoint operators - expectation value - stationary state - Hermitian operators for dynamical variables - eigen values and functions- orthonormality - commutation relations.

UNIT-II: APPLICATIONS (15 Hours)

One dimensional problems – Wells; Infinite square well and finite square well and barriers; Rectangular barrier - Harmonic Oscillator by Schrödinger equation and operator method (I&III D) - Rigid rotator - Hydrogen Atom.

UNIT-III: ANGULAR MOMENTUM (15 Hours)

Angular momentum operator - commutation rules - Eigen value spectrum - Ladder Operators - Momentum Eigen values and Eigen function - L2 Operators Eigen values and Eigen function - Spin matrices and wave function- combination of two angular momentum - Clebsch Gordon coefficients.

UNIT-IV: APPROXIMATION METHODS (15 Hours)

Perturbation theory - Non degenerate and degenerate cases- removal of degeneracy - application to ground state of anharmonic oscillator - Variation method - Hydrogen Molecule - Zeeman and Stark effects - WKB approximation.

UNIT-V: RELATIVISTIC QUANTUM MECHANICS (15 Hours)

The Klein-Gordon equation- probability density and current density- The Dirac's equation and Dirac's matrices- Plane wave solutions of the Dirac's equation- Spin as an inherent property of an electron- Covariant form of Dirac's equation- Gamma matrices and their properties- Positive and negative energy states and Dirac's explanation.

Text books:-

1. Introduction to Quantum Mechanics, David J. Griffiths.2005
2. Ghatak and Loganathan A.K, *Quantum Mechanics,* Macmillan. 1992
3. Mathews P.M and Venkatesan, *Quantum Mechanics,* Tata McGraw Hill.1977
4. Satya Prakash and Singh C.K, *Quantum Mechanics*.2014
5. Gupta S.L, Kumar V, Sharma R.C and Sharma H.V, *Quantum Mechanics,* Jai Nath& Co. 2007
6. Chatwal and Anand, *Quantum Mechanics,* Himalaya & Co.
7. BransdenJoachain quantum mechanics solutions manual.

REFERENCE:-

1. Feynmann Lectures, *Quantum Mechanics,* Vol. - III. 2013
2. Powel and Craseman, *Quantum Mechanics,* Addison-Wesley.1961
3. J.J Sakurai, Modern Quantum Mechanics.1984
4. Gupta S.L. and Gupta I.D, *Advanced Quantum Mechanics and Field,* S. Chand & Co.2004
5. V. K. Thangappan, *Quantum Mechanics, New Age International Pvt. Ltd.2004*
6. *V. Devanadhan, Quantum Mechanics, Alpha Science.2011*

I-M.Sc SEM- II	Course Code: 18PPH24	Title of the Paper: PHYSICS OF NANOMATERIALS	HRS/WK 5	CREDITS 4

Course Outcomes	
CO1	Explore the basics of nano physics
CO2	Study the synthesis of nano crystals.
CO3	Understand the various characterization techniques.
CO4	Synthesis and types of carbon nanotutbes
CO5	Understand the applications of nano materials

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	Programme Outcomes POs					Programme Specific Outcomes PSOs						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	1.4	3.3	1.1	3.1	2.3	4.2	4.2	4.1	3.8	4.7	2.3	3.13
CO2	1.2	3.5	1.3	3.2	2.6	4.4	4.3	4.1	3.9	4.2	2.1	3.16
CO3	1.6	3.8	1.4	3.2	2.6	4.8	4.6	3.9	3.8	4.0	2.4	3.28
CO4	1.8	3.8	1.4	3.2	2.4	4.5	4.1	3.9	4.2	3.5	2.1	3.17
CO5	1.2	3.6	1.1	3.3	2.9	4.1	4.4	4.0	4.1	4.3	2.1	3.19
Mean Overall Score												3.186

Result: The Score for this course is High

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ PSOs}$

Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

Unit – I INTRODUCTION TO NANOPARTICLES (15Hours)

Introduction – Historical perspective of nano particle – Classification of nanomaterials – Zero Dimension, 1D, 2D & 3D nano particle – Nano material preparation – Plasma arching – Chemical Vapour Deposition – Solgel electro deposition – Ball milling technique.

Unit – II NANO CRYSTALS (15 Hours)

Synthesis of metal nanoparticles and structures – Background on quantum semiconductors - Background on reverse Miceller solution - Synthesis of semiconductors - Cadmium telluride nano crystals - Cadmium sulfide nano crystals - Silver sulfide nano crystals - Nano Manipulator - Nano tweezes – quantum dots.

Unit - III SIZE DEPENDENT PROPERTIES (15 Hours)

Magnetism in particle of reduced size dimension – Variation of magnetism with size-Magnetic behaviour of small particle-Diluted magnetic semiconductors (DMS) - their applications - Nanomaterials in catalysis-Nanostructure adsorbents - Nanoparticle as chemical reagents - Specific heat of nanoparticles crystals - Melting point of nanoparticle material – Nanolithograpy -Estimation of nanoparticle size using XRD, TEM, AFM & MFM.

Unit - IV NANOTUBES (15 Hours)

New form of carbon-Types of nanotubes-Formation of nanotubes-Various techniques-Preparation and properties of nanotubes-Uses of nanotubes and applications-Nanomaterial processing for nanotube-Light and nanotechnology-Nanoholes and photons-Quantum electronic devices-Quantum information and quantum computers.

Unit – V APPLICATIONS (15Hours)

Micromechanical system – Robots - Ageless material – Nanomechanics –Nanoelectronics - Optoeletronic devices – Micro Electro Mechanical System (MEMS) and Nano Electro Mechanical System (NEMS), Applications - Colourants and Pigments - Nano bio technology - DNA chips - DNA array devices - Drug delivery systems.

TEXT BOOKS:-

1. Kenneth J.Klabunde, 2001; *Nanoscale Materials in chemistry*, a john Wiley &Sons, Inc., Publication.
2. De Jongh.J, 1994; *Physics and chemistry of metal cluster compounds*. Kulwer Academic publisher, Dordrecht.
3. Henrich. V, Cox P.A, 1994; *Metal oxides, Cambridge university press*, New york.
4. Ed. George C.Hadjipanyis and Gary A. Prinz, 1991; NATO ASI Series, *Science and technology of Nanostructured Magnetic Materials*, Plenum press, New York.
5. T. Pradeep, 2007; Nano: The Essentials: Understanding Nanoscience and Nanotechnology, *Tata McGraw-Hill Education.*

REFERENCE BOOKS:-

1. Jiles.D, 1991; *Introduction to Magnetism and Magnetic and Magnetic Materials*, Chapman and Hall, London
2. Christof M. Niemeyer & Chad A. Mirkin 2004; *Nano Bio*
3. Charles Poole, *Introduction to nanotechnology.*
4. *Introduction to Nanotechnology, Charles B. Poole, Jr and Frank J. Owens, Wiley International, 2003.*
5. *Guozhong Cao and Ying Wang, Nano Structures and Nano Materials, Second Edition, World Scientific Publishers, 2004.*

I M.Sc SEM- II	Course Code: 18EPPH24	MEDICAL PHYSICS	HRS/WK 5	CREDITS 4

Course Outcomes

CO1	Get the knowledge of production of X-ray images and applications
CO2	Acquire knowledge about vitro and in vivo testing
CO3	Aware of knowledge of ultrasound in medicine
CO4	Get the knowledge about the adiotherapy
CO5	Get the basic ideas of neuroelectrics and neuromagnetics

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	Programme Outcomes POs					Programme Specific Outcomes PSOs						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	2.1	3.8	2.0	3.5	2.2	4.6	3.2	3.4	4.3	3.4	2.1	3.14
CO2	2.2	3.6	2.2	3.4	2.1	4.1	3.4	3.8	4.4	3.2	2.1	3.13
CO3	2.3	2.2	2.4	3.3	2.2	4.4	3.4	3.7	4.6	3.3	2.1	3.08
CO4	2.4	2.4	2.0	3.1	2.1	4.3	3.2	3.6	4.4	3.5	2.3	3.02
CO5	2.6	2.4	2.4	2.8	2.4	4.7	3.3	3.8	3.1	3.8	2.1	3.18
Mean Overall Score												3.11

Result: The Score for this course is High

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

Value Scaling

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

Mean Overall Score of COs= $\frac{\text{Total Mean Scores}}{\text{Total No.of COs}}$

UNIT I X-RAY IMAGING (15 Hours)

Production of X-ray images, attenuation coefficients, choice of suitable energy, contrast, hardware; digital imaging X-ray computed tomography, five generations of scanners, reconstruction methods, CT number, contrast stretching-Optical Chromatography.

UNIT II NUCLEAR MEDICINE (15 Hours)

In vitro and in vivo testing, gamma rays for imaging, radiopharmaceuticals, the gamma camera, SPECT, PET, examples of clinical use.

UNIT III ULTRASOUND IN MEDICINE (15 Hours)

Ultrasound imaging, generation and detection of ultrasound, ultrasound propagation, choice of frequency, A-scan, B-scan, M-mode imaging and echo cardiography. Use of Doppler techniques for blood flow etc. Use of ultrasound in therapy

UNIT IV RADIOTHERAPY (15 Hours)

Effect of radiation on normal and malignant tissue, cell survival Types of radiotherapy unit: low voltage, orthovoltage, megavoltage, electron beam, brachytherapy Dosimetry: calculation and measurement of dose, % depth dose, isodose lines, scattering effects Treatment planning, fractionation, conformal radiotherapy- Photodynamic Therapy.

UNIT V NEUROELECTRICS AND NEUROMAGNETICS (15 Hours)

Basic electrophysiology, genesis of electric and magnetic signals Techniques for measurement and imaging of EEG, ECG, MEG and MCG.

TEXT BOOKS:-

1. Webb. S (Ed), The Physics of Medical Imaging, Hilger 1988
2. Dendy. P.P and B Heaton, Physics of Diagnostic Radiology, IOPP 2012
3. Brown. B.H et. al., Medical Physics and Biomedical Engineering IOPP 1999
4. Duck. F, Ultrasound in Medicine, IOPP 2009
5. Krestel. E, Imaging Systems for Medical Diagnostics, Siemens 1990

REFERENCE BOOKS:-

1. Maisey, Britton and Gilday (Eds), Clinical Nuclear Medicine, Chapman and Hall 1991
2. Hendee. W.R, Radiation Therapy Physics, Mosby 2004
3. HedrickW.R, DL Hykes, and DE Starchmann, Ultrasound Physics and Instrumentation, Mosby 1995
4. Steele. G, *Basic Clinical Radiobiology*, Arnold 2002
5. Carlton. R and A. Adler, Principles of Radiographic Imaging, Delmar 2005
6. Cameron.J.R and J.G. Skofonick, *Medical Physics*, Wiley1978
7. Delchar. T.A, *Physics in Medical Diagnosis*, Chapman and Hall 1997

I – M.Sc (Physics)	GENERAL PRACTICAL -II	18PPHP21
SEMESTER – II		HRS/WK – 4
CORE – PRACTICAL-II		CREDIT –4

Any 7 out of 10

1. Electrical resistance of a metal / alloy by four probe's method.
2. F. P etalon using spectrometer.
3. Determination of Planck's constant.
4. Cauchy's dispersion constant.
5. Determination of dielectric constant of solids.
6. Ultrasonic interferometer - Viscosity and Compressibility of liquids.
7. Hall effect experiment - Determination of charge carrier density.
8. Polarisibility of Liquids using hollow prism.
9. Susceptibility of a liquid by Quincke's method.
10. Michelson's interferometer.

I – M.Sc (Physics)	ELECTRONICS PRACTICAL – II	18PPHP23
SEMESTER - II		HRS/WK – 4
CORE – PRACTICAL -II		CREDIT – 4

Any 7 out of 10

1. Op-amp solving simultaneous equations
2. Up-down counters – Design of modulus counters
3. IC 555 – Monostablemultivibrator, frequency divider
4. Op-amp I to V and V to I converters
5. D/A converter using comparator R-2R ladder network.
6. Shift registers
7. Schmitt trigger
8. Wein bridge oscillator using Op-amp.
9. Phase shift oscillator using Op-amp.
10. Logic Simplification With Karnaugh Maps
11. Implementation of 4-bit parallel adder using 7483 IC.
12. Design & verify the operation of magnitude comparator.

YEAR- II SEM- III	Course Code: 18PPH31	Title of the Paper: MOLECULAR PHYSICS	HRS/WK 5	CREDITS 4

Course Outcomes	
CO1	Understand the concepts microwave and IR spectroscopy
CO2	Understand concept of Raman spectroscopy and its applications
CO3	Understand the concepts molecular quantum
CO4	Study the electronic spectra of molecules
CO5	Acquire the knowledge of nuclear spectroscopy

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	**Programme Outcomes POs**					**Programme Specific Outcomes PSOs**						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	4	4	3.5	4	3.8	3.5	3	3.5	3.5	3.5	3	3.57
CO2	2.5	4	3	4	4	3.5	3.5	3.5	4	4	3.5	3.59
CO3	3.5	3.5	4	3.5	3.5	3.5	4	4	3.5	3	3.5	3.59
CO4	3	4.5	3.5	4	3.5	4	3	3	3.5	4	3.5	3.59
CO5	3	4	2.5	4	4	4	3.5	3.5	4	3.5	4	3.64
Mean Overall Score												3.60

Result: The Score for this course is High

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

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

UNIT-I: MICROWAVE (MW) AND INFRARED (IR) SPECTROSCOPY (15Hours)

Classification of rotating molecules – rotational spectra of linear and symmetric top molecules - Stark modulation MW spectrometer - IR spectrometer – diatomic molecules as harmonic and anharmonic oscillators- rotation –vibration spectra diatomic molecules – P,O and R branches- analysis of symmetric top molecules – Principle, Instrumentation and applications of FTIR.

UNIT-II: RAMAN SPECTROSCOPY (15 Hours)

Raman Effect - Molecular polarisability – Quantum theory – Pure rotational Raman spectra of diatomic and poly atomic molecules – Vibration - rotation Raman spectra of diatomic and polyatomic molecules - Application of Raman spectroscopy for the structure determination of H_2O molecule. Laser Raman spectroscopy – Principle, Instrumentation and applications of FTRAMAN spectroscopy.

UNIT-III: UV-VISIBLE SPECTROSCOPY (15 Hours)

Molecular quantum number – coupling of angular momenta - classification of states- electronic spectra of diatomic molecules - Frank Condon principle - Vibrational structure of electronic bands - Rotational fine structure - Fortrat parabola and band head formation- dissociation energy.

UNIT-IV: NMR SPECTROSCOPY (15 Hours)

Concepts of NMR spectroscopy- Chemical shift- spin-spin coupling between two and more nuclei - application to structural determination of molecules- spin - spin and spin lattice relaxation processes - FTNMR – measurement of relaxation times by pulse sequence technique.

UNIT-V: ESR, NQR and MOSSBAUER SPECTROSCOPY (15 Hours)

Concept of ESR spectroscopy - effect of L-S coupling - Lande splitting factor 'g" – Hyperfine and fine structure.General principles of NQR spectroscopy, Instrumentation and its applications. Mossbauer spectroscopy - recoilless emission and absorption - Mossbauer spectrometer- Isomer shift – Nuclear quadrupole splitting - Zeeman splitting.

TEXT BOOKS:-

1. Banwell CN and McCash E.M, 1994, *Fundamentals of Molecular Spectroscopy*, 4^{th} Edition, Tata McGraw-Hill Publications, New Delhi.
2. Aruldas G, 2001, *Molecular structure and spectroscopy*, Prentice,-Hall of India Pvt.Ltd., New Delhi.
3. Satyanarayana D.N, 2004, *Vibrational spectroscopy and applications*, New age international Publications, New Delhi.
4. Atta U Rahman, 1986, *Nuclear Magnetic Resonance*, SpringerVerlag, Newyork.
5. Towne and Schawlow, 1995, *Microwave Spectroscopy*, McGraw- Hill,
6. D.A.Lang, *Raman Spcetroscopy*, McGraw- Hill international, N.Y.
7. Jenkens and white, Basics of Spectroscopy.

REFERENCE:-

1. Raymond Chang, 1980, *Basic Principles of spectroscopy*, McGraw- Hill, Kogakusha, Tokyo.
2. Straughan B.P. and Walker, *Spectroscopy-Vol* 1, Chapman and Hall, London, 1996.
3. Straughan B.P. and Walker, *Spectroscopy-Vo*l 2, Chapman and Hall, London, 1996.
4. Straughan B.P. and Walker, *Spectroscopy-Vol 3*, Chapman and Hall, London, 1996.
5. Hore P.J, *Nuclear Magnetic Resonance* – Oxford Science Publications 1995.

II M.Sc SEM- II	Course Code: 18PPH32	Title of the Paper: QUANTUM MECHANICS – II	HRS/WK 5	CREDITS 4

Course Outcomes	
CO1	Study transition under constant perturbation and transition probability
CO2	Understand the concepts of scattering theory
CO3	Study the identical particles.
CO4	Understand the semi classical treatment of radiation
CO5	Acquire knowledge of quantization of fields.

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	**Programme Outcomes POs**					**Programme Specific Outcomes PSOs**						Mean Score of CO’s
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	4	4	3.5	4	3.5	4	4	3.5	3.5	4	3.5	3.77
CO2	3.5	3.5	3.5	4	4	3.5	4	3.5	4	4	4	3.77
CO3	4	4	4	3.5	4	3.5	3.5	3.5	3.5	4	4	3.77
CO4	4	3.5	3.5	3.5	3.5	3	2.5	4	4	3.5	4	3.55
CO5	3.5	4	3.5	4	3.5	3.5	4	4	3.5	3.5	3.5	3.68
Mean Overall Score												3.71

Result: The Score for this course is High

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ PSOs}$

Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

UNIT-I EVOLUTION WITH TIME (15 Hours)

Transition under constant perturbation - Transition probability - Fermi Golden Rule- Harmonic perturbation - Adiabatic and sudden approximations - Schrödinger picture - Heisenberg's picture - Interaction picture.

UNIT-II SCATTETING THEORY (15 Hours)

Collision in three dimension and scattering- laboratory and CM reference frames- Scattering Amplitude- Differential scattering cross section- Total scattering cross section- Scattering by spherically symmetrical potentials- partial waves and phase shifts- Born's approximation and its validity- square well, Yukawa potential and Rutherford's formula.

UNIT-III IDENTICAL PARTICLES (15 Hours)

Symmetric and antisymmetric wave functions – collision of identical particles – spin angular momentum – spin functions for a many – electron system – Slater's determinant – HartreeFock Method.

UNIT-IV SEMICLASSICAL TREATMENT OF RADIATION (15 Hours)

Spontaneous and induced emission of radiation from semi - classical theory - Einstein's coefficients for induced and spontaneous emission and the relation between them - Electric di-pole and forbidden transition- selection rules.

UNIT-V QUANTISATION OF FIELDS (15 Hours)

Relativistic Lagrangian and Hamiltonian of a charged particle in an electromagnetic field – Lagrangian and Hamiltonian formulations of fields- Second quantization of Klein Gordon field – creation and annihilation operators – commutation rules – Quantization of electromagnetic and Schrodinger's field.

TEXT BOOKS:-

1. Ghatak A.K and Loganathan, *Quantum Mechanics*, Macmillan 1999
2. Mathews P.M and Venkatesan, *Quantum Mechanics,* Tata McGraw Hill 1977
3. Satya Prakash, Advanced*Quantum Mechanics*.2008
4. Gupta S.L, Kumar V, Sharma R.C, and H.V Sharma, *Quantum Mechanics*, Jai Nath& Co 2007
5. Chatwal and Anand, *Quantum Mechanics*, Himalaya & Co
6. Messiah A.P, *Quantum Mechanics*. 2013
7. Steven Weinberg, Lectures on Quantum Mechanics.2011
8. AmitabhaLahiri and Palash Pal, A First Book of Quantum Field Theory.2001

REFERENCE BOOKS:-

1. Feynmann Lectures, *Quantum Mechanics,* Vol.- III 2013
2. Powel and Craseman, *Quantum Mechanics,*(Addison-Wesley) 1962
3. Schiff L.I, *Quantum Mechanics,* McGraw Hill 1968
4. Gupta S.L, Gupta I.D, *Advanced Quantum Mechanics and Field,* S. Chand & Co.2010
5. *V. Devanadhan, Quantum Mechanics, Alpha Science.2005*

II-M.Sc SEM- III	Course Code: 18PPH33	Title of the Paper: CONDENSED MATTER PHYSICS	HRS/WK 5	CREDITS 4

Course Outcomes

CO1	Acquire knowledge crystals and to study crystal structure by x-ray diffraction pattern
CO2	Explore the various defects in crystals
CO3	Understand the band theory of solids
CO4	Acquire knowledge of superconductors
CO5	study the ferro electric and magnetic systems

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	**Programme Outcomes POs**					**Programme Specific Outcomes PSOs**						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	3.5	4	3.5	3	3	3	3	2.5	3.5	3	3.5	3.23
CO2	3.5	4	4	4	4	2.5	2.5	4	4	4	4	3.68
CO3	3	3.5	3	2.5	4	4	4	3.5	3.5	4	4	3.55
CO4	3	3.5	2.5	3.5	4	3.5	4	3.5	4	3.5	3.5	3.50
CO5	4	3.5	4	3.5	3.5	4	3.5	3.5	3.5	3.5	3.5	3.64
Mean Overall Score												3.52

Result: The Score for this course is High

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ PSOs}$ Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

UNIT-I CRYSTAL PHYSICS (15 Hours)

Unit cell - two and three dimensional Bravais lattices - Miller indices – reciprocal lattices - interaction of X-rays with matter - absorption of X-rays- elastic scattering from a perfect lattice - X-ray intensity and atomic configuration of unit cell - Diffraction of X-rays by crystals - application of reciprocal lattice in diffraction techniques - The Laue's powder and rotating crystal methods - crystal structure factor and diffraction of neutrons by crystals- temperature dependence of reflection lines – Debye - Waller factor.

UNIT-II CRYSTAL DEFECTS (15 Hours)

Crystal imperfections - point defects and phonon defects - ionic conductivity and lattice defects – Colourcentres- F-centres - dislocations-dislocation densities - elementary ideas of crystal growth - grain boundaries - dislocations in plastic deformation and crystal growth - X-rays and electron microscope techniques in crystal imperfection studies.

UNIT-III ELECTRONS IN SOLIDS (15 Hours)

Electrons in a periodic lattice - Bloch theorem - band theory - Effective mass- Classification of solids – metals - semiconductors and insulators – Phonons - Fermi surface- Brillouin Zones - construction of Fermi surfaces - Experimental methods in Fermi surface studies- Cyclotron resonance – magnetoresistance - De Haas Van Alphen effect.

UNIT-IV SUPERCONDUCTIVITY (15 Hours)

Phenomena of superconductivity - Meissner effect - Type I and II superconductors- Thermodynamics of superconducting transitions - London's equation - Cooper pairing - BCS theory of superconductivity- Ginzbung - London theory- Josephson theory - D.C and A.C. Josephson effect - Quantum interference - vortices and Type II superconductors – Introduction to High temperature superconductors.

UNIT-VMULTIFERROIC SYSTEMS (15 Hours)

Polarization – dielectric constants – interval field – electric polarizability – ferroelectric crystals – displacive transitions – antiferroelectricy – ferroelectric domain – piezo electricity – interaction between magnetic ions – Curie Weiss law – exchange interaction – internal field – spin waves – ferromagnetic domains – anti ferromagnetism – behavior of antiferromagnets above and below Neel temperature.

TEXT BOOKS:-

1. Kittel. C, 1995, *Introduction toSolid State Physics, 7th Edition,* John Wiley & Sons
2. M.A. Wahab, Solid State Physics: Structure and Properties of Materials.2009
3. Pillai S.O, 1997, *Solid State Physics,* New Delhi, New Age International
4. Dekker, *Solid State Physics*1995
5. Kachava. C.M, 1990, *Solid State Physics,* New Delhi, Tata McGrawHill
6. Verma and Srivastava, *Crystallography for Solid State Physics 2006*
7. *HP Myers Introductory solid state physics. 1997*
8. *H. Ibach and H. Lüth. Solid-State Physics. An Introduction to Theory and Experiment.*1993
9. Omar, *Elementary Solid State Physics*1993

REFERENCE BOOKS:-

1. Azaroff, *Introduction to Solids*
2. Aschroft and Mermin, *Solid State Physics*1958
3. Blakemore.J.S, 1974, Solid *State Physics*, 2nd Edition, Philadelphia, W.B Saunders & Co.
4. Chaikin and Lubensky, *Principles of Condensed Matter Physics*2000
5. Cullity, *Elements of X-ray Diffraction2010*

II-M.Sc SEM- III	Course Code: 18EPPH34	Title of the Paper: MICROPROCESSOR 8086 AND MICROCONTROLLER	HRS/WK 5	CREDITS 3

Course Outcomes

CO1	Acquire knowledge of Intel 8086 architecture and instruction set
CO2	Get basis knowledge of modular programming and multiprogramming
CO3	Know the basis of I/o consideration, interrupts and system bus structure
CO4	Acquire knowledge about Intel 8051 micro controller
CO5	Get the idea how to Interfacing i/o and memory with 8051

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	**Programme Outcomes POs**					**Programme Specific Outcomes PSOs**						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	1.1	3.5	1.2	3.3	2.2	4.4	4.3	4.1	4.5	3.6	2.4	3.14
CO2	1.2	3.8	1.3	3.3	2.1	3.9	3.7	3.7	3.9	3.7	2.2	2.98
CO3	1.6	3.8	1.2	3.1	2.3	4.8	4.1	3.8	3.8	3.9	2.5	3.17
CO4	1.2	3.4	1.6	3.6	2.5	3.9	4.2	4.6	4.3	4.6	2.2	2.95
CO5	1.4	4.0	1.1	3.7	2.2	4.0	3.9	4.2	4.5	4.3	2.1	3.21
Mean Overall Score												3.09

Result: The Score for this course is High

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ PSOs}$

Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

UNIT-1: INTEL 8086 ARCHITECTURE AND INSTRUCTION SET (15 Hours)

Internal architecture of 8086 - Software model - Internal registers - Minimum mode and Maximum mode system - Instruction set - Addressing modes – Data transfer, Arithmetic, Logical, Shift and rotate instruction – Compare, Jump, Loop, String, Processor control, CALL - RET and stack instructions - Procedures - Assembler Macros - Assembler directives.

UNIT-11: MODULAR PROGRAMMING AND MULTIPROGRAMMING (15 Hours)

Linking and relocation – access to external identifiers – procedures – interrupts and their routines – macros – process management and IRMX86 – semaphore operations – common procedure sharing.

UNIT-III: I/O CONSIDERATION, INTERRUPTS AND SYSTEM BUS STRUCTURE(15 Hours)

Programmed I/O – Interrupt I/O – block transfer and DMA – basic 8086 bus configuration – minimum and maximum modes – system bus timings – interrupt priority management – single and multiple 8259.

UNIT-IV INTEL 8051 MICRO CONTROLLER (15 Hours)

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

UNIT-IV - Interfacing I/O and Memory With 8051 (15 Hours)

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

TEXT BOOKS:-

1. Yu-cheng Liu, Glen A. Gibson, 2006, *Microcomputer System 8086/8088 Family*, Prentice – Hall of India.
2. Douqlas V. Hall, 2005, *Microprocessor interfacing, Programming and Hardware*, Tata McGraw-Hill
3. Vijayendran V, 2005, *Fundamentals of Microprocessor – 8086*, 3rd Edition Visvanathan Pvt. Ltd.
4. Muhammad Ali Mazidi, 2006, *the 8051 Microcontroller and Embedded Systems*, First Impression, Pearson Prentice Hall.

REFERENCE BOOKS:-

1. Barry B Brey, 1995, *The Intel Microprocessor 8086/8088, 80186, 80286, 80386 and 80486*, 3rd Edition, New Delhi, Prentice Hall of India.
2. Uffrenbeck J, *The 8086/8088 Family – Design*, Programming and Interfacing, Software, Hardware and Applications, New Delhi, Prentice Hall of India.1994
3. Tribel W.A and Avtar Singh, *The 8086/8088 Microprocessors Programming*, Interfacing, Software, Hardware and Applications, New Delhi, Prentice Hall of India.1999

II-M.Sc SEM- III	Course Code: 18EPP34A	Title of the Paper: COMMUNICATION PHYSICS	HRS/WK 5	CREDITS 4

Course Outcomes	
CO1	Know the basic of FM, SSB & ISB transmission methods.
CO2	Acquire the knowledge of digital modulation and satellite communication.
CO3	Understand the concept of transmission and reception of TV signals
CO4	Acquire knowledge on modern communication system
CO5	study the basics of fiber optic communication

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	Programme Outcomes POs					Programme Specific Outcomes PSOs						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	1.4	3.3	1.1	3.1	2.3	4.2	4.2	4.1	3.8	4.7	2.3	3.13
CO2	1.2	3.5	1.3	3.2	2.6	4.4	4.3	4.1	3.9	4.2	2.1	3.16
CO3	1.6	3.8	1.4	3.2	2.6	4.8	4.6	3.9	3.8	4.0	2.4	3.28
CO4	1.8	3.8	1.4	3.2	2.4	4.5	4.1	3.9	4.2	3.5	2.1	3.17
CO5	1.2	3.6	1.1	3.3	2.9	4.1	4.4	4.0	4.1	4.3	2.1	3.19
Mean Overall Score												3.186

Result: The Score for this course is High

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ PSOs}$

Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

UNIT-I FM TRANSMISSION (15 Hours)

Frequency modulation – FM radio frequency band – Direct frequency modulation – modulation index – FM wave equation – Bandwidth – deviation ratio – voltage distribution – power – reactance modulation – FM radio receiver (Block diagram) - SSB Transmission – Advantages and disadvantages –Balanced Modulators – Separation of sidebands – Filter method – the phase shift method – ISB – ISB receiver.

UNIT-II DIGITAL MODULATION, MULTIPLEXING AND SATELLITE COMMUNICATION(15 Hours)

Digital Modulation – codes – Data forms – Transmission modes between stations – Modems – Pulse amplitude modulation – Time division multiplexing – pulse width modulation – pulse position modulation – frequency division multiplexing – satellite communication – Geostationary satellites – Communication satellites – satellite subsystems – Earth stations – domestic satellites.

UNIT-III TELEVISION (15 Hours)

Television transmission – television pictures and cameras – Interlaced scanning and picture resolution – Tonal and colour characteristics of pictures – composite B & W and colour video signals – colour TV transmitter – Television reception – colour receiver plan – Electronic tuner – IF subsystem – receiver sound system – Y signal channel – chroma decoder – Raster circuits – EHT generation – receiver picture tubes – remote control of receiver functions.

UNIT-IV TELEPHONE SYSTEM AND MODERN COMMUNICATION SYSTEM(15 Hours)

Telephony – Telephone Instruments – Telephone transmitter and receiver – Electronic telephone – Dialler – Ringer – Transmission bridges – Telephone relays – Local Battery exchanges and central battery exchange – Automatic telephony – crowbar exchange – cross bar switch and exchange – electronic telephone exchanges – SLIC – advantages and disadvantages of digital transmission – FACSIMILE and cellular radio systems.

UNIT-V FIBER OPTIC COMMUNICATION (15Hours)

Fiber materials – glass fibers – plastic clad glass fiber – plastic fibers – fiber optic communications – propagation theory – numerical aperture – classification of optical fibers – scalar wave equation and solution to step index fiber – loss mechanism in optical fibers – signal distortion due to dispersion – amount of dispersion in a step index fiber.

TEXT BOOKS:-

1. Robert. J Schoenbeck, 1999, *Electronic communications*, Prentice Hall of India (P) Ltd, New Delhi.
2. Gulati R.R, 2000, *Composite Satellite and Cable Television*, New Age international.
3. Anokh Singh, 1999, *Principle of Communication Engineering*, Chand & Co, New Delhi.
4. Louis E. Frenzel, 1994, *Communication Electronic*, McGraw Hill.

REFERENCE BOOKS:-

1. Cerin, *Introduction to Optical Fibers,* McGraw Hill 1982
2. B.B. Laud, *Laser and Nonlinear Optics,* Wiley Eastern Limited 1991

II – M.Sc (Physics)	GENERAL PRACTICAL -III	18PPHP31
SEMESTER - III		HRS/WK - 4
CORE – PRACTICAL-III		CREDIT - 4

Any 7 out of 10

1. e- Millikan's oil drop method.
2. Dielectric constant Lecher Wires.
3. Resistivity of semiconductor.
4. Biprism – Wave length and thickness
5. Spectrometer – Refractive index of different liquids using Hollow prism.
6. Test the validity of the Hartmann's prism dispersion formula using the visible region of mercury spectrum
7. Thickness Of Mica Sheet Using Edser Butler Method using spectrometer.
8. Measurement of wave length of He-Ne laser light using ruler.
9. Magnetic Susceptibility, Gouy 's method.
10. Half shade polarimeter - determination of the specific rotation of sugar solution.

II – M.Sc (Physics)	**MIROPROCESSOR PRACTICAL – I**	**18PPHP32**
SEMESTER - III		**HRS/WK - 4**
CORE – PRACTICAL - III		**CREDIT - 4**

Experiments may be combined to make 7 out of 25

1. Program to Increment an 8-bit Number
2. Program to Increment a 16-bit Number
3. Program to Decrement an 8-bit Number
4. Program to Decrement a 16-bit Number
5. Program to Find 1's Complement of an 8-bit Number
6. Program to Find 1's Complement of a 16-bit Number
7. Program to Find 2's Complement of an 8-bit Number
8. Program to Find 2's Complement of a 16-bit Number
9. Program to Add Two 8-bit Numbers
10. Program to Add Two 16-bit Numbers
11. Program to Subtract Two 8-bit Numbers
12. Program to Subtract Two 16-bit Numbers
13. Program to Multiply Two 8-bit Unsigned Numbers
14. Program to Multiply Two 16-bit Unsigned Numbers
15. Program to Multiply Two 8-bit Signed Numbers
16. Program to Multiply Two 16-bit Signed Numbers
17. Program to Divide 16-bit Unsigned Number by an 8-bit Unsigned Number
18. Program to Divide 16-bit Signed Number by an 8-bit Signed Numbers
19. Sum of 'n' consecutive numbers
20. Conversion of BCD number to decimal
21. Separating Odd and Even numbers
22. Curve fitting – Least Square fitting with algorithm, flowchart – C Program.
23. Solution of a Polynomial equation and determination of roots by NewtonRaphson Method with algorithm, flowchart – C Program
24. Program for Addition and Subtraction of two numbers using Microcontroller 8051
25. Program for Multiplication and Division of two numbers using Microcontroller 8051

YEAR- II SEM- IV	Course Code: 18PPH41	Title of the Paper: NUCLEAR & PARTICLE PHYSICS	HRS/WK 5	CREDITS 4

Course Outcomes	
CO1	Understand the concepts of various nuclear models
CO2	Study the central force and tensor force in the molecular system.
CO3	Understand the concepts of nuclear reaction
CO4	Study the theory of beta decay
CO5	Acquire the knowledge of particle physics

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	**Programme Outcomes POs**					**Programme Specific Outcomes PSOs**						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	3.5	3	3	3.5	3.5	4	3.5	3	3.5	3.5	3.5	3.41
CO2	3.5	3	4	3.5	3.5	4	3.5	3.5	2.5	4	3.5	3.50
CO3	3.5	3.5	3	3	3.5	3.5	4	3.5	4	3.5	3.5	3.50
CO4	4	3.5	2.5	3	3.5	3.5	3.5	4	3.5	4	4	3.55
CO5	3.5	4	3.5	4	4	3.5	3.5	4	3.5	4	3	3.68
Mean Overall Score												3.53

Result: The Score for this course is High

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

Value Scaling

Mean Score of COs= $\frac{\text{Total Values}}{\text{Total No.of POs \&}}$

Mean Overall Score of COs= $\frac{\text{Total Mean Scores}}{\text{Total No.of COs}}$

UNIT-I NUCLEAR MODELS **(15 Hours)**

Liquid drop model- Bohr Wheeler theory fission- Experimental evidence for shell effects- Shell model-Spin orbit coupling- Magic numbers- Angular Momenta and parities of nuclear ground states- Qualitative discussion and estimates of transition rates- magnetic moments and Schmidt lines- Collective model of Bohr and Mottelson- oblate and prolate deformation of Nucleus.

UNIT-II NUCLEAR FORCE **(15 Hours)**

Central force and tensor forces- Ground state of deuteron- Magnetic and quadrupole moments- Charge independence and spin dependence of nuclear forces-n-p scattering and p-p scattering at low energies-effective range theory- High energy nucleon- nucleon scattering-Exchange forces- Meson theory of nuclear forces.

UNIT-III NUCLEAR REACTIONS **(15 Hours)**

Types of reactions and conservation laws- energetics of nuclear reactions- reaction dynamics- Q – value equation- scattering and reaction cross section- compound nucleus- scattering matrix- fission and controlled fission reactions, fission reactors – fission explosives - fusion, solar fusion – thermonuclear reactions and weapons.

UNIT-IV NUCLEAR DECAY **(15 Hours)**

Beta decay- Fermi theory of beta decay- Shape of the beta spectrum- Total decay rate- Angular momentum and parity selection rules- Comparative half-lives- allowed and forbidden transitions- Selection rules- Parity violations- Two component theory of neutrino decay- Detection and properties of neutrino- Gamma decay.

UNIT-V PARTICLE PHYSICS **(15 Hours)**

Baryons and Mesons- their properties, decay models- Strong, weak and electromagnetic interactions- Hadrons and Leptons, Tau-Theta puzzle- Strangeness- Gellman- Nishijima-relations- SU(3) classifications of Hadrons-Octets and decouplets-elementary ideas of Quarks – New particles.

TEXT BOOKS:-

1. Srivastava B.N, *Basic Nuclear Physics,* Pragathi Prakasan.1962
2. Tayal D.C, *Nuclear Physics,* Himalaya Publications.1970
3. Pandya M.L, *Elementary Nuclear Physics,* KedarNath Ram Nath.
4. Enge H.A, *Introduction to Nuclear Physics,* Addison-Wesley.1966
5. Concepts of Nuclear Physics – B.L. Cohen (Wiley-Eastern)1989
6. Griffiths D, *Introduction to Elementary Particles,* Harper and Row.1987

REFERENCE BOOKS:-

1. Elton, *Introductory Nuclear Theory,* Pitman.1966
2. Waghmare Y.R, *Introductory Nuclear Physics,* Oxford-IBH.1981
3. Kaplan I, *Nuclear Physics,* Narosa.1989
4. Kenneth S. Krane, I*ntroductory Nuclear Physics, Wiley-Eastern 1987*

YEAR- III SEM- IV	Course Code: 18PPH42	Title of the Paper: RESEARCH METHODOLOGY, COMPUTATION METHODS & PROGRAMMING	HRS/WK 5	CREDITS 4

Course Outcomes	
CO1	To understand the Principles of Scientific Research
CO2	To Understand Qualitative & Quantitative Analysis
CO3	Understanding the Plotting & Analyzing Origin
CO4	To Learn the Programming using Matlab
CO5	To study the Python Programming

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	**Programme Outcomes POs**					**Programme Specific Outcomes PSOs**						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	1.1	4.1	1.2	3.3	1.0	4.2	4.2	4.1	4.3	4.3	1.0	2.98
CO2	1.0	3.3	1.0	3.2	1.0	4.2	4.1	4.2	4.3	4.3	1.0	2.87
CO3	1.0	3.4	1.0	3.6	1.1	4.4	4.4	4.6	4.4	4.5	1.1	2.65
CO4	1.1	3.3	1.0	3.5	1.0	4.4	4.8	4.1	4.2	4.2	1.0	2.87
CO5	1.0	4.0	1.1	3.2	1.0	4.3	4.3	4.1	1.0	4.4	1.1	2.68
Mean Overall Score												2.81

Result: The Score for this course is Moderate

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ PSOs}$

Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

UNIT-I: PRINCIPLES OF SCIENTIFIC RESEARCH (15 Hours)

Identification of the problem- Literature survey – Reference collection – Familiarity with ideas and concept of investigation –Internet Browsing –Drawing inference from data.

UNIT-II: ANALYSIS AND RESEARCH WRITING (15 Hours)

Art of writing a research paper, Synopsis ,Research Project and Thesis - Seminar -Power point presentation.

UNIT-III: ORIGIN GRAPHING AND ANALYSIS (15 Hours)

Linear curve fitting - non-linear curve fitting - model validation - dataset comparison tools - multi-dimensional data analysis- Peak Analysis.

UNIT –IV: STARTING WITH MATLAB, CREATING ARRAYS (15 Hours)

Starting with MATLAB, MATLAB Windows – Working in the Command windows –
Arithmetic Operations with Scalars – Display formats – Elementary Math Built in functions –Defining Scalar Variable – Creating one dimensional arrays and creating two dimensional arrays.

UNIT – V: PYTHON PROGRAMMING ENVIRONMENT (15 Hours)

Fundamental python programming techniques such as lambdas, reading and manipulating csv files, and the numpy library - Data manipulation and cleaning techniques.

TEXT BOOK:

Research Methodology – Methods and Techniques (Third Edition) C.R. Kothari and G. Garg 1990

REFERENCE BOOKS:

NekaneGuarrotxena, Research Methodology in Physics and Chemistry of Surfaces and Interfaces. 2014

II – M.Sc (Physics)	MATERIALS SCIENCE	EPPH1014
SEMESTER - IV		HRS/WK - 5
ELECTIVE – 4A		CREDIT - 4

Objectives

- To understand the classification of materials.
- To study various phase diagrams.
- To know the phase transformation and nucleation.
- To learn the electron theory of metals
- To study the electric and magnetic properties of materials.

Unit I CLASSIFICATION OF MATERIALS (15 Hours)

Engineering materials- Material structure- Types of Bonds and their energies – Bond formation mechanism- Ionic bond-covalent bond examples-ceramics- thermal and electrical properties – uses- Metallic bond- comparison of bond (dispersion bonds, dipole bonds and hydrogen bonds)-Crystal imperfection –Types of imperfections- Thermal vibrations – point, line and surface imperfections- Frank –Read source.

Unit II PHASE DIAGRAMS (15 Hours)

Basic terms- solid solutions- Hume – Rothery's rules- intermediate phase- Gibb's Phase rules- Time – temperatures cooling curves- construction of phase diagrams- the Lever rule- eutectic systems- eutectoid - Systems- peritectic and peritectoid system-Ternary equilibrium diagrams.

Unit-III PHASE TRANSFORMATION (15 Hours)

Rate of transformation- nucleation (homogeneous and heterogeneous)-nucleation and growth – applications of phase transformations – micro constituent of iron – carbon system –the allotropy of iron – Iron-Carbon equilibrium diagram- formation of Austenite- TTT diagram- transformation Austenite upon continuous cooling.

Unit IV ELECTRON THEORY OF METALS (15 Hours)

Fundamental theories of electrons (Drude and Lorentz theory and Sommerfield free electron theory) –electron energies in a metal- Zone theory of solids- energy gaps – density of states – Zones in conductors, insulators and semiconductors - factors affecting electrical resistance of materials.

Unit V ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS (15 Hours)

Resistivity- conductivity- semiconductors –classsification of semiconductors on the basis of Fermi energy and Fermi levels- insulators –dielectrics –ferro electricity –electro strict ion- Piezo electricity – uses of dielectrics –capacitors dielectric strength- magnetic properties of materials –magneto strict ion-magnetic domain –soft and hard magnetic materials.

TEXT BOOKS:-

1. Saxena B.S, Gupta. R.C and Saxena .P.N, Fundamentals of Solid State Physics
2. Singhal.R.L, 2000-2001, Solid State Physics, KedarNath Ram Nath& Co, Meerut.
3. Kittel C,1992, Introduction to Solid State Physics, New India Publishing House.

REFERENCE BOOKS:-

1. Raghavan.V, 1990, *Materials Science and Engineering a first course, III Ed,* PrenticeHall of India.
2. Structural M, 1990, *Materials Science,* Anuradha Agencies & Publishers
3. Manchandra. V.K, 1992, *a Text Book of Materials Science,* New India Publishing House.
4. William D. Calister, Fundamentals of Material Science & Engineering, Jr. John William & sons Inc, 2001.

II MSC SEM-IV	Course Code: 18EPPH43	Title of the Paper: ELECTRONIC INSTRUMENTATION	HRS/WK 5	CREDITS 4

Course Outcomes	
CO1	Understand the various transducers
CO2	Study digital instrumentation methods
CO3	Know the analytical instrumentation techniques
CO4	Study the bio medical instrumentation
CO5	Apply the knowledge of computer peripherals

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	Programme Outcomes POs					Programme Specific Outcomes PSOs						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	3.2	2.6	4	3.5	3	2.8	3.5	3	4	3.1	3.2	3.26
CO2	3.4	3.2	3	3.1	3.5	3.6	4.1	3	3	2.6	3.5	3.27
CO3	3.5	4	3.2	2.8	3	3.2	3.1	3.5	3.4	3.5	3	3.29
CO4	3.2	3.4	3	4	3.1	3.5	3.3	2.8	3.5	3.5	3.6	3.35
CO5	4.2	3.5	3.5	3.2	3.5	2.5	3.6	3	4.1	3.4	3.5	3.45
Mean Overall Score												3.32

Result: The Score for this course is High

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ PSOs}$

Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

UNIT-I: TRANSDUCERS (15 Hours)

Classification of transducers –Principle, construction and working of Thermistor, LVDT, Electrical strain gauges and capacitive transducers - Measurement of non –electrical quantities –strain, Displacement, temperature, pressure and force.

UNIT-II: DIGITAL INSTRUMENTATION (15 Hours)

Principle, block diagram and working of Digital frequency counter. Digital multimeter, digital pH meter, digital conductivity meter and digital storage oscilloscope.

UNIT-III: ANALYTICAL INSTRUMENTATION (15 Hours)

Principle ,block diagram , description ,working and application of UV-VIS Spectrometer, IR spectrometer, Flame emission spectrometer and ICP-AES Spectrometer – Basic concept of gas and liquid chromatography.

UNIT-IV BIO –MEDICAL INSTRUMENTATION (15 Hours)

Physiological transducers to measure blood pressure, body temperature. Source of Bio- electric potentials – resting potential action potential, bio-potential, block diagram and operation of ECG an EEG –Records.

UNTI-V: COMPUTER PERIPHERALS (15 Hours)

Printers – Printer mechanism – Classification - Dot matrix, Ink jet and Laser printer .Basic concept of key board and mouse - Mass data storage - floppy disk – Hard Disk -Operation Dick(CD) - Pen drive (thumb drive).

TEXT BOOKS:-

1. Rajendra Prasad, *Electronic Measurement and instrumentation*, Khanna Publications.2001
2. Ramambhadran S, *Electronic Measurements & Instrumentation,* Khanna Publications.1986
3. Dhir S.M, *Electronics and instrumentation*, Khanna Publications.2009
4. Khandpur, *Hand Book of Biomedical Instrumentation*, TMH. Publications.

REFERENCE BOOKS:-

1. Gromwell L, *Bio medical instrumentation and measurement*, Prentice Hall.2010
2. John R. Cameran and James G. Skofronick, 1978, *Medical physics*, John Wiley & Sons.
3. Aplen E.L, 1990, *Radiation Physics,* Prentice Hall.

II MSC SEM-IV	Course Code: 18EPP43A	ASTRONOMY AND ASTROPHYSICS	HRS/WK 5	CREDITS 4

Course Outcomes

CO1	Understand the principles of relativity.
CO2	Know the different frame works of relativity
CO3	Study the Einstein's equation and its solutions
CO4	Acquire the knowledge of cosmological models
CO5	Explore the thermal history of the universe

Mapping of course outcomes with the program specific outcomes

Course Outcomes COs	Programme Outcomes POs					Programme Specific Outcomes PSOs						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	4	4	3.5	4	3.5	4	4	3.5	3.5	4	3.5	3.77
CO2	3.5	3.5	3.5	4	4	3.5	4	3.5	4	4	4	3.77
CO3	4	4	4	3.5	4	3.5	3.5	3.5	3.5	4	4	3.77
CO4	4	3.5	3.5	3.5	3.5	3	2.5	4	4	3.5	4	3.55
CO5	3.5	4	3.5	4	3.5	3.5	4	4	3.5	3.5	3.5	3.68
Mean Overall Score												3.71

Result: The Score for this course is High

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

Value Scaling

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

Mean Overall Score of COs= $\frac{\text{Total Mean Scores}}{\text{Total No.of COs}}$

UNIT I PRINCIPLES OF RELATIVITY (15 Hours)

Overview of Special Relativity, space time diagrams, Lorentz metric, light cones, electrodynamics in 4 dimensional language. Introduction to general relativity (GR), equivalence principle, gravitation as a manifestation of the curvature of space time.

UNIT II GEOMETRICAL FRAMEWORK OF GENERAL RELATIVITY (15 Hours)

Curved spaces, tensor algebra, metric, affine connection, covariant derivatives, physics in curved space time, curvature - Riemann tensor, Bianchi identities, action principle, Einstein's field equations, energy momentum tensors, energy-momentum tensor for a perfect fluid, connection with Newton's theory.

UNIT III SOLUTIONS TO EINSTEIN'S EQUATIONS AND THEIR PROPERTIES (15 Hours)

Spherical symmetry, derivation of the Schwarzschild solution, test particle orbits for massive and massless particles. The three classical tests of GR, blackholes, event horizon - one way membranes, gravitational waves.

UNIT IV COSMOLOGICAL MODELS (15 Hours)

Cosmological principle, Robertson-Walker metric, cosmological redshift, Hubble's law, observable quantities - luminosity and angular diameter distances, dynamics of Friedmann-Robertson- Walker models: Solutions of Einstein's equations for closed, open and flat universes.

UNIT V PHYSICAL COSMOLOGY AND THE EARLY UNIVERSE (15 Hours)

Thermal history of the universe: Temperature-redshift relation, distribution functions in the early universe - relativistic and non-relativistic limits. Decoupling of neutrinos and the relic neutrino background - nucleosynthesis - decoupling of matter and radiation; cosmic microwave background radiation - inflation - origin and growth of density perturbations.

TEXT BOOKS:

1. General Relativity and Cosmology, J. V. Narlikar, Delhi: Macmillan Company of India Ltd. 1977
2. Classical Theory of Fields, Vol. 2, L. D. Landau and E. M. Lifshitz, Oxford :Pergamon Press. 1971
3. First Course in General Relativity, B. F. Schutz, Cambridge University Press. 2009
4. Introduction to Cosmology, J. V. Narlikar, Cambridge University Press. 2002
5. Structure Formation in the Universe. T. Padmanabhan, Cambridge University Press.1993

REFERENCE BOOKS:

1. Telescopes and Techniques, C.R.Kitchin, Springer. 2014
2. Observational Astrophysics, R.C. Smith, Cambridge University Press. 1995
3. Detection of Light: from the Ultraviolet to the Submillimetre, G. H. Rieke, Cambridge University Press. 1995
4. Astronomical Observations, G. Walker, Cambridge University Press. 1987
5. Astronomical Photometry, A.A. Henden& R.H. Kaitchuk, Willmann-Bell. 1990
6. Electronic Imaging in Astronomy, I.S. McLean, Wiley-Praxis. 1997
7. An Introduction to Radio Astronomy, B. F. Burke & Francis Graham-Smith, Cambridge University Press. 2010
8. Radio Astronomy, John D. Kraus, Cygnus-Quasar Books.1986

II MSC SEM-IV	Course Code: 18PPH44	Title of the Paper: Scientific Analysis	HRS/WK 5	CREDITS 4

Course Outcomes: At the end of the course, the student will be able to

CO1	Solve the problems on Mathematical Methods of Physics and Classical Mechanics
CO2	Solve the problems on Electromagnetic Theory and Quantum Mechanics
CO3	Solve the problems on Thermodynamic and Statistical Physics , Electronics and Experimental Methods
CO4	Solve the problems on Atomic & Molecular Physics ,Condensed Matter Physics
CO5	Solve the problems on Nuclear and Particle Physics

Mapping of course outcomes with the program specific outcomes

Course Outcomes Cos	Programme Outcomes POs					Programme Specific Outcomes PSOs						Mean Score of CO's
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	5	5	5	5	4	5	5	5	5	5	4	4.818
CO2	5	5	5	5	4	5	5	5	5	5	4	4.818
CO3	5	5	5	5	4	5	5	5	5	5	4	4.818
CO4	5	5	5	5	4	5	5	5	5	5	4	4.818
CO5	5	5	5	5	4	5	5	5	5	5	4	4.818
Mean Overall Score												4.818

Result: The Score for this course is VERY HIGH

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

Value Scaling

Mean Score of COs= $\frac{Total\ Values}{Total\ No.of\ POs\ \&\ PSOs}$

Mean Overall Score of COs= $\frac{Total\ Mean\ Scores}{Total\ No.of\ COs}$

Any One Unit Out Of Ten (Problems only)
Online mode of Examination.

UNIT-I. Mathematical Methods of Physics (60 Hours)

Dimensional analysis. Vector algebra and vector calculus. Linear algebra, matrices, Cayley-Hamilton Theorem. Eigenvalues and eigenvectors. Linear ordinary differential equations of first & second order, Special functions (Hermite, Bessel, Laguerre and Legendre functions). Fourier series, Fourier and Laplace transforms. Elements of complex analysis, analytic functions; Taylor & Laurent series; poles, residues and evaluation of integrals. Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem. Green's function. Partial differential equations (Laplace, wave and heat equations in two and three dimensions). Elements of computational techniques: root of functions, interpolation, extrapolation, and integration by trapezoid and Simpson's rule, Solution of first order differential equation using Runge-Kutta method. Finite difference methods. Tensors. Introductory group theory: SU (2), O (3).

UNIT-II.Classical Mechanics (60 Hours)

Newton's laws. Dynamical systems, Phase space dynamics, stability analysis. Central force motions. Two body Collisions - scattering in laboratory and Centre of mass frames. Rigid body dynamics-moment of inertia tensor. Non-inertial frames and pseudo forces. Variational principle. Generalized coordinates. Lagrangian and Hamiltonian formalism and equations of motion. Conservation laws and cyclic coordinates. Periodic motion: small oscillations, normal modes. Special theory of relativity-Lorentz transformations, relativistic kinematics and mass–energy equivalence. Dynamical systems, Phase space dynamics, stability analysis. Poisson brackets and canonical transformations. Symmetry, invariance and Noether's theorem. Hamilton-Jacobi theory.

UNIT-III.Electromagnetic Theory (60 Hours)

Electrostatics: Gauss's law and its applications, Laplace and Poisson equations, boundary value problems. Magnetostatics: Biot-Savart law, Ampere's theorem. Electromagnetic induction. Maxwell's equations in free space and linear isotropic media; boundary conditions on the fields at interfaces. Scalar and vector potentials, gauge invariance. Electromagnetic waves in free space. Dielectrics and conductors. Reflection and refraction, polarization, Fresnel's law, interference, coherence, and diffraction. Dynamics of charged particles in static and uniform electromagnetic fields. Dispersion relations in plasma. Lorentz invariance of Maxwell's equation. Transmission lines and wave guides. Radiation- from moving charges and dipoles and retarded potentials.

UNIT-IV.Quantum Mechanics (60 Hours)

Wave-particle duality. Schrödinger equation (time-dependent and time-independent). Eigenvalue problems (particle in a box, harmonic oscillator, etc.). Tunneling through a barrier. Wave-function in coordinate and momentum representations. Commutators and Heisenberg uncertainty principle. Dirac notation for state vectors. Motion in a central potential: orbital angular momentum, angular momentum algebra, spin, addition of angular momenta; Hydrogen atom. Stern-Gerlach experiment. Time-independent perturbation theory and applications. Variational method. Time dependent perturbation theory and Fermi's golden rule, selection rules. Identical particles, Pauli Exclusion Principle, spin-statistics connection. Spin-orbit coupling, fine structure. WKB approximation. Elementary theory of scattering: phase shifts, partial waves, Born approximation. Relativistic quantum mechanics: Klein-Gordon and Dirac equations. Semi-classical theory of radiation.

UNIT-V.Thermodynamic and Statistical Physics (60 Hours)

Laws of thermodynamics and their consequences. Thermodynamic potentials, Maxwell relations, chemical potential, phase equilibria. Phase space, micro- and macro-states. Micro-canonical, canonical and grand-canonical ensembles and partition functions. Free energy and its connection with thermodynamic quantities. Classical and quantum statistics. Ideal Bose and Fermi gases. Principle of detailed balance. Blackbody radiation and Planck's distribution law. First- and second-order phase transitions. Diamagnetism, paramagnetism, and ferromagnetism. Ising model. Bose-

Einstein condensation. Diffusion equation. Random walk and Brownian motion. Introduction to non-equilibrium processes.

UNIT-VI.Electronics and Experimental Methods (60 Hours)

Semiconductor devices (diodes, junctions, transistors, field effect devices, homo- and hetero-junction devices), device structure, device characteristics, frequency dependence and applications. Opto-electronic devices (solar cells, photo-detectors, LEDs). Operational amplifiers and their applications. Digital techniques and applications (registers, counters, comparators and similar circuits). A/D and D/A converters. Microprocessor and microcontroller basics.

Data interpretation and analysis. Precision and accuracy. Error analysis, propagation of errors. Least squares fitting, Linear and nonlinear curve fitting, chi-square test. Transducers (temperature, pressure/vacuum, magnetic fields, vibration, optical, and particle detectors). Measurement and control. Signal conditioning and recovery. Impedance matching, amplification (Op-amp based, instrumentation amp, feedback), filtering and noise reduction, shielding and grounding. Fourier transforms, lock-in detector, box-car integrator, modulation techniques. High frequency devices (including generators and detectors).

UNIT-VII. Atomic & Molecular Physics (60 Hours)

Quantum states of an electron in an atom. Electron spin. Spectrum of helium and alkali atom. Relativistic corrections for energy levels of hydrogen atom, hyperfine structure and isotopic shift, width of spectrum lines, LS & JJ couplings. Zeeman, Paschen-Bach & Stark effects. Electron spin resonance. Nuclear magnetic resonance, chemical shift. Frank-Condon principle. Born-Oppenheimer approximation. Electronic, rotational, vibrational and Raman spectra of diatomic molecules, selection rules. Lasers: spontaneous and stimulated emission, Einstein A& B coefficients. Optical pumping, population inversion, rate equation. Modes of resonators and coherence length.

UNIT-VIII. Condensed Matter Physics (60 Hours)

Bravais lattices. Reciprocal lattice. Diffraction and the structure factor. Bonding of solids. Elastic properties, phonons, lattice specific heat. Free electron theory and electronic specific heat. Response and relaxation phenomena. Drude model of electrical and thermal conductivity. Hall effect and thermoelectric power. Electron motion in a periodic potential, band theory of solids: metals, insulators and semiconductors. Superconductivity: type-I and type-II superconductors. Josephson junctions. Superfluidity. Defects and dislocations. Ordered phases of matter: translational and orientational order, kinds of liquid crystalline order. Quasi crystals.

UNIT-IX. Nuclear and Particle Physics (60 Hours)

Basic nuclear properties: size, shape and charge distribution, spin and parity. Binding energy, semi-empirical mass formula, liquid drop model. Nature of the nuclear force, form of nucleon-nucleon potential, charge-independence and charge-symmetry of nuclear forces. Deuteron problem. Evidence of shell structure, single-particle shell model, its validity and limitations. Rotational spectra. Elementary ideas of alpha, beta and gamma decays and their selection rules. Fission and fusion. Nuclear reactions, reaction mechanism, compound nuclei and direct reactions. Classification of fundamental forces. Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.). Gellmann-Nishijima formula. Quark model, baryons and mesons. C, P, and T invariance. Application of symmetry arguments to particle reactions. Parity non-conservation in weak interaction. Relativistic kinematics.

PG THEORY EXAMINATION

Continuous internal assessment (CIA) (25 marks)

Two internal Examinations	15 marks
Assignment / Seminar	10 marks
Total	**25 marks**

External Examination (75 marks)

Time: 3 Hours **Max. Marks: 75**

Section – A (5 X 6 = 30)

(Answer all the questions)

(One question from each Unit; either or pattern and any two of the questions will be a problem; any one part)

Section B (3 X 15 = 45)

(Answer any Three Questions out of five)

(One Question from each unit and it may have subdivisions; the subdivisions may have problems)

PRACTICAL EXAMINATION

Continuous internal assessment (CIA) (40 marks)

Based on the periodical evaluation of record &
Experiments assessed by the staff in charge - 20 marks

Model Practical examination - 20 marks

External Examination (60 marks)

4 Hrs. Exam

Total Marks: 60

- Experiment 50 Marks
- Viva 5 Marks
- Record 5 Marks