KONGUNADU ARTS AND SCIENCE COLLEGE
(AUTONOMOUS)
COIMBATORE -641029

DEPARTMENT OF PHYSICS (PG)

CURRICULM AND SCHEME OF EXAMNINATIONS (CBCS)

(2018-2019 ONWARDS)

KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)
COIMBATORE -641029

Vision:

- Developing the total personality of each and every student in a holistic way by adhering to the principles of Swami Vivekananda and Mahatma Gandhi**.**

Mission:

- Imparting holistic and man-making education with emphasis on character, culture and values - moral and ethical.
- Designing the curriculum and other courses that transform its students into value added and skilled human resources.
- Constantly updating academic and management practices towards total quality management and promotion of quality in all spheres.
- Extending the best student support services by making them comprehensive and by evolving a curriculum relevant to student community and society at large.
- Taking steps to make education affordable and accessible by extending scholarships to the meritorious and economically disadvantaged students.
- Motivating teachers in such a way that they become the role models in promoting Higher Education.

DEPARTMENT OF PHYSICS

Vision:

The goal of the Department of Physics is to bring eminence and excellence in teaching learning process and to fetch ours as one of the Benchmark Department with "Potential for Academic excellence"

Mission:

To execute the teaching profession to bring the students as an asset for a productive and fascinating career, successful in their life and to realize learning with real world experience.

PROGRAMME OUTCOME (PO)

Upon successful completion of the Programme, the student will be able to

PO1: Develop knowledge of scientific phenomena, facts, laws, concepts, theories, scientific quantities and their determination, scientific and technological applications as well as their social, economic and environmental implications.

PO2: Think critically; interpret precise concepts to arrive at scientific conclusions.

PO3: Acquire relevant information from a variety of sources and be able to communicate scientific information in a clear, concise and logical manner both verbally and in writing.

PO4: Students are expected to acquire a basic knowledge in various branches of Physics.

PO5: Students are expected to develop written and oral communication skills in communicating Physics related topics.

PO6: Students will realize and develop an understanding of the impact of Physics and Science on the society.

PO7: Apply conceptual understanding of Physics in other disciplines such as Engineering, Mathematics, Computer science and Chemistry.

PO8: Demonstrate the ability to do advanced lab experiments that apply the principles learned in the class rooms.

PROGRAMME SPECIFIC OUTCOME (PSO)

1. Students are expected to acquire a basic knowledge in various branches of Physics.
2. Students are expected to develop written and oral communication skills in communicating Physics related topics.
3. Students will realize and develop an understanding of the impact of Physics and Science on the society.
4. Apply conceptual understanding of Physics in other disciplines such as Engineering, Mathematics, Computer science and Chemistry.
5. Demonstrate the ability to do advanced lab experiments that apply the principles learned in the class rooms.

PPH1

KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

COIMBATORE-641 029

M.Sc.. PHYSICS

Curriculum and Scheme of Examination under CBCS

(Applicable to students admitted during the Academic year 2018–2019 and onwards)

Semester	Subject code	of the Paper	Instruction hours/cycle	Exam. Marks			Duration of Exam. Hrs.	Credit
				CIA	ESE	Total		
I	18PPH101	**C.P 1**- Classical Mechanics	5	25	75	100	3	5
	18PPH102	**C.P 2**- Mathematical Physics	5	25	75	100	3	5
	18PPH103	**C.P 3**- Modern Optics	5	25	75	100	3	5
	18PPH1N1	**1N1 – Non Major Elective I**	5	25	75	100	3	5
	18PPH2CL	**C. Pr 1**- General Experiments	5	-	-	-	-	-
	18PPH2CM	**C. Pr 2**- Electronics Experiments	5	-	-	-	-	-
			30	**100**	**300**	**400**		**20**

II	18PPH204	**C.P 4**- Quantum Mechanics –I	5	25	75	100	3	4
	18PPH205	**C.P 5**- Thermodynamics and Statistical mechanics	5	25	75	100	3	4
	18PPH206	**C.P 6**- Thin Film Physics, Plasma Physics and Crystal growth	4	25	75	100	3	4
	18PPH207	**C.P 7**- Nuclear and Particle Physics	4	25	75	100	3	4
	18PPH2N2	**2N2 – Non Major Elective II**	4	25	75	100	3	5
	18PPH2CL	**C.Pr 1** - General Experiments	4	40	60	100	4	3
	18PPH2CM	**C.Pr 2** - Electronics Experiments	4	40	60	100	4	3
			30	**205**	**495**	**700**		**27**

III	18PPH308	**C.P 8**- Quantum Mechanics-II	5	25	75	100	3	5
	18PPH309	**C.P 9**- Electromagnetic theory and Electrodynamics	5	25	75	100	3	5
	18PPH310	**C.P.10** Solid State Physics	5	25	75	100	3	5
	18PPH3E1	**3E1 - Major Elective I**	5	25	75	100	3	5
	18PPH4CN	**C. Pr 3**- Advanced Experiments	5	-	-	-	-	-
	18PPH4CO	**C. Pr 4** - Special Electronics Experiments	5	-	-	-	-	-
			30	**100**	**150**	**400**		**20**

PPH2

IV	18PPH411	**C.P. 11** Communication Physics	5	25	75	100	3	4
	18PPH412	**C.P 12** - Atomic & Molecular Spectroscopy	5	25	75	100	3	4
	18PPH4E2	**4E2 - Major Elective II**	5	25	75	100	3	5
	18PPH4CN	**C. Pr 3** - Advanced Experiments	5	40	60	100	6	3
	18PPH4CO	**C. Pr 4** - Special Electronics Experiments	5	40	60	100	6	3
	18PPH4Z1	**Project and Viva Voce**	5	40	160	200	-	4
			30	**195**	**505**	**700**		**23**
		Total				**2200**		**90**

Major Elective Papers

(2 papers are to be chosen from the following 4 papers)

1. Nanotechnology: Principles and Applications
2. Atmospheric Science
3. Biomedical Instrumentation
4. Problems in Physics

Non - Major Elective papers

(2 papers are to be chosen from the following 4 papers)

1. Electronics and Microprocessors
2. Applied Physics
3. Energy Physics
4. Industrial Physics

Tally Table

Part	Subject	No. of Subjects	Marks	Credits
I	Core – Theory / Practical / Project	18	1800	70
	Major Elective Paper	2	200	10
	Non-Major Elective Paper	2	200	10
	Grand Total	22	2200	90

Note:

- CBCS - Choice Based Credit System
- CIA - Continuous Internal Assessment
- ESE - End of Semester Examination

Question Paper Pattern for CIA and ESE

Theory

Maximum marks: 75

Section - A (10 × 1 = 10 marks)

Q.No. 1 to 10: Multiple choice types alone with four distracters each

Section - B (5 × 5 = 25 marks)

Q.No. 11 to 15: Either or / essay type question (One question ‘a’ or ‘b’ from each unit.)

Note: In Section B, one question should be a problem from any of the five units (both the options ‘a’ and ‘b’)

Section - C (5 × 8 = 40 marks)

Q. No. 16 to 20: Either or / essay type question (One question ‘a’ or ‘b’ from each unit.)

PPH4

1. Breakup marks for CIA of Theory	
CIA Exam	15
Assignment	5
Attendance	5
Total	**25**
2. Components of Practical	
Break up marks for CIA of Practical	
CIA Practical Exam	25
Observation Notebook/Regularity	10
Attendance	5
Total	**40**
Breakup marks for ESE of Practical	
*Experiment	50
Record	10
Total	**60**
*** Breakup marks for Experiment (50 Marks)**	
Formula and its expansion	10
Circuit diagram/ Figure/Graph	5
Observation and Tabulation	5
Skill	15
Calculation	10
Result and neatness	5
Total	**50**

3. Component for Project

CIA/ESE	Particulars	
CIA	Project Review	30
	Regularity	10
	Total Internal Marks	**40**
*ESE	Project Report Presentation	120
	Viva Voce	40
	Total External Marks	**160**
Total Marks (CIA + ESE)		**200**

:

* Projects report and Viva voce will be evaluated jointly by Project Supervisor (Faculty of the Department) and an External Examiner.

PPH5

Course Code: 18PPH101

Programme code : 03		**M.Sc Physics**		
Course Code: 18PPH101		**Core Paper 1 – Classical Mechanics**		
Batch **2018-2019**	**Semester** **I**	**Hours/Week** **5**	**Total Hours** **75**	**Credits** **5**

Course Objective

To enable the learners to know about the

1. Mechanics of single and system of particle,
2. Generalised coordinates, Lagrangian formulation and mechanics of rigid body motion,
3. Hamiltonian formulation of mechanics, Hamilton-Jacobi theory, harmonic oscillator problem, theory and applications of small oscillations.

Course outcome (CO)

K1	**CO1**	Know about Newtonian mechanics which provides models of the mechanical behavior of objects; conservation principles involving momentum, angular momentum, energy which the fundamental equations of motion.
K2	**CO2**	Get knowledge about coordinate transformations, oscillatory motion, gravitation and other central forces, Lagrangian mechanics and applications of Lagrangian mechanics to solve the physical problems.
K3	**CO3**	Get knowledge about Mechanics of Rigid Body motion.
K4	**CO4**	Know about the theory of small oscillations and its applications

Unit – I **15 hrs**

Mechanics of Single and System of Particles

Newton's laws of motion – Mechanics of a particle- Equation of motion of a particle – Motion of a particle under constant force and alternating force – Mechanics of systems of particles – Angular momentum of the system – Potential and kinetic energies of the system – Motion in a central force field – Motion of two particles equivalent to single particle – Equation o motion of centre of mass with respect centre of force – Motion in an inverse square law force field – Classification of orbits.

Unit – II **15 hrs**

Lagrangian Formulation

Generalized coordinates and constraints – principle of virtual work and D'Alembert's principle – Lagrange's equation for a conservative system – velocity dependent potentials and dissipation function. Hamilton's principle – Lagrange's equations of motion from this principle – extension of the principle to non-conservative and non-holonomic systems – conservation theorems and symmetry properties. Applications for Lagrangian and Variational Principle: simple pendulum, compound pendulum, double pendulum, triple pendulum, simple harmonic oscillators

PPH6

Course Code: 18PPH101

Unit - III **15 hrs**

Mechanics of Rigid Body Motion

Generalized coordinates for rigid body motion – Euler's integrals – infinitesimal rotations – Coriollis force – application of a free fall of a body on earth's surface and Foucault's pendulum – moments and products of inertia – Euler's equation of motion – **force free motion of a symmetrical rigid body – heavy symmetrical top under gravity – fast top and sleeping top conditions*.**

Unit - IV **15 hrs**

Hamiltonian Formulation

Hamilton's equation of motion – cyclic coordinates and Routh's procedure – conservation theorem – Hamilton's equation of motion from variational principle – principle of least action – canonical transformation – equations of canonical transformation and generating functions – examples of canonical transformations – integral invariance of Poincare-Lagrange and Poisson's brackets – equations of motion in Poisson bracket notation – Jacobi's identity-infinitesimal contact transformations – angular momentum – Poisson bracket relations – Liouville's theorem.

UNIT – V **15 hrs**

Hamiolton-Jacobi Theory and Small Oscillations

Hamilton-Jacobi equations for Hamilton's principle and characteristic functions – harmonic oscillator problem – separation of variable method – action angle variables – applications – linear harmonic oscillator and Kepler problem – theory of small oscillations – Eigen value equations – normal modes and normal coordinates – application to triatomic molecule.

* **Self study**

Teaching Methods: Seminar / Discussion / Assignment

Books for study:

1. Goldstein, Pearson (2014) Classical Mechanics, New International 3rd Edition
2. Gupta, S.L.Kumar and Sharma (2012) Classical Mechanics Pragathi Edition

Books for Reference:

1. Gupta and Sathya Prakash (2000) Classical Mechanics , Kedar Nath Ram Nath & Co
2. Rana and Joag (2001) Classical Mechanics Tata McGraw-Hill Education

Mapping					
	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	**S**	**H**	**S**	**S**	**H**
CO 2	**S**	**H**	**S**	**S**	**H**
CO 3	**H**	**S**	**S**	**H**	**S**
CO 4	**S**	**H**	**H**	**S**	**S**
S- Strong		**H-High**		**M-Medium**	**L – Low**

PPH7

Course Code: 18PPH102

Programme code : 03		M.Sc Physics		
Course Code: 18PPH102		**Core Paper 2 - Mathematical Physics**		
Batch **2018-2019**	**Semester** **I**	**Hours/Week** **5**	**Total Hours** **75**	**Credits** **5**

Course Objective

To enable the learners to

1. Understand complex variables, group theory & tensors
2. Know about different differential equations and partial differential equations in Physics
3. Study about some of the numerical methods

Course outcome (CO)

K1	**CO1**	Have a good understanding of complex analytsis including important theorems and determination of residues to evaluate certain types of definite integrals
K2	**CO2**	Solve physically relevant partial differential equations using the method of separation of variables and be familiar with the most important special functions such as Bessel, Legendre and Hermite to solve differential equations
K3	**CO3**	Have knowledge in abstract group theory and tensors
K4	**CO4**	Apply numerical methods to obtain appropriate solutions to mathematical problems

UNIT I **15 hrs**

Complex variables

Elements of complex analysis –**Taylor and Laurent series** *- Cauchy- Riemann differential equation-Complex line integrals-Cauchy's integral theorem – Cauchy's integral formula- derivatives of an analytic function–Singularities of an analytic function- Residues and their evaluation - Cauchy's residue theorem – Evaluation of definite integrals by contour integration – integration round the unit circle of the type f(cosθ, sinθ)dθ - evaluation of f(x)dx.

UNIT II **15 hrs**

Differential equations

Bessel differential equation: Series Solution –Bessel's function of a first kind- Half order Bessel function - Recurrence formula for $J_n(x)$ – Generating function for $J_n(x)$.

Legendre's differential equation: Series solution Legendre polynomials- Generating function- Recurrance relations – Rodrigue formula - Orthogonality of Legendre's polynomials.

Hermite's differential equation: Series solution – Hermite polynomials – Generating function – Recurrance formula – Rodrigue's formula for Hermite polynomials - Orthogonality of Hermite polynomials

UNIT III **15 hrs**

Group theory and Tensors

Group Theory

Definition of groups – groups of transformation – multiplication table (C_{4v})- conjugate elements and classses – sub groups - cyclic groups - cosets - Lagrange's theorem- normal subgroups - factor subgroups - reducible and irreducible representation of a group- Schur's lemma- orthogonality theorem – construction of character table for C_{2V}.

PPH8

Course Code: 18PPH102

Tensors

Introduction – n-dimensional space – superscripts and subscripts – coordinate transformation – indicial and summation conventions – dummy and real indices – Kronecker delta symbol – scalars, contravariant and covariant vectors – tensors of higher ranks – algebraic operations of tensors.

UNIT IV **15 hrs**

Partial differential equations in Physics

Introduction – solution of Laplace's equation in Cartesian co-ordinates – solution of Laplace's equation in two dimensional cylindrical co-ordinates(r, θ); circular harmonics- solution of Laplace equation in general cylindrical co-ordinates ; cylindrical harmonics- solution of Laplace's equation in spherical polar co-ordinates; spherical harmonics-diffusion equation or Fourier equation of heat flow- solution of heat flow equation; (method of separation of variables) - two dimensional heat flow - three dimensional heat flow.

UNIT V **15 hrs**

Numerical Analysis

Bisection and Newton – Raphson's method of finding roots of the equation - Giraffe's root squaring method of solving algebraic equation- Gregory-Newton forward &backward interpolation formulae - solution of simultaneous linear equation by Gauss elimination and Gauss - Jordans method – solution of ordinary differential equation by Euler method and Runge - Kutta second and fourth order methods – Evaluation of integral by means of Trapezoidal and Simpson's one third rule.

* **Self study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for study:

1. Sathya Prakash (2000) Mathematical Physics, Sulthan Chand & Sons
2. M. K.Venkataraman (2001)Numerical Methods in Science and Engineering Mathematics National Publishing & Co

Books for Reference:

1. B.D Guptha (2006) Mathematical Physics, Vikas Publishing House, 3 Edition
2. A.W.Joshi (2009) Elements of group theory for Physicists, New age International Publications
3. A.Singaravelu (2000) Meenakshi Publishing Co

Mapping					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	H	H	S	H
CO 2	H	S	S	H	S
CO 3	S	H	S	S	H
CO 4	S	H	S	H	H
S- Strong	H-High		M-Medium		L - Low

Course Code: 18PPH103

Programme code : 03		M.Sc Physics		
Course Code: 18PPH103		Core Paper 3 – Modern Optics		
Batch 2018-2019	Semester I	Hours/Week 5	Total Hours 75	Credits 5

Course Objective

To explore

1. Necessary and sufficient condition for laser
2. Basic principles involved in Non-linear optical effects
3. Different types of optical fibers and its applications

Course outcome (CO)

K1	**CO1**	Acquire basic knowledge about optics of solids, scattering, polarization
K2	**CO2**	Understand about Magneto-optic effects ,Electro-optic effects and non-linear optical effects
K3	**CO3**	Acquire relevant information about fabrication of optical fibers by various processes about latest developed fibres. fiber optic sensors and their application in medical field
K4	**CO4**	Have good knowledge about various fiber optic sensors and their application in medical field.They also know about fiber losses in core ,cladding material and also dispersion in fibres.

UNIT I **12 hrs**

Polarization and Optics of Solids

Scattering and Polarization – circular and Elliptical Polarization – Quarter wave plate – Matrix representation of Polarization – The Jones calculus – Orthogonal polarization – propagation of light in crystals – Phase-velocity surface – pointing vector and the Ray velocity – The ray velocity surface double refraction at a boundary – polarizing prisms – Optical activity – Susceptibility tensor of an optically active medium.

UNIT II **12 hrs**

Magneto-optic and Electro-optic effects

Faraday rotation in Solids – Kerr electro optic effect – The Cotton-Mouton effect – The Pockels effect

Non-linear optical effects

Wave propagation in an anisotropic crystal – Polarization response of materials to light - Second order Non linear optical processes: Second harmonic generation - Sum and Difference Frequency generation – Optical Parametric Oscillation - Third order Non linear optical processes: Third harmonic generation – Intensity dependent Refractive index – Self focusing – nonlinear optical materials – Phase matching – Description of phase matching – Achieving phase matching – Angle tuning – Temperature tuning – Types of Phase matching

PPH10

Course Code: 18PPH103

OPTICAL FIBERS

Unit – III - Fiber fabrication and Plastic fibers

Fiber fabrication: 12 hrs

Classification of Fiber Fabrication techniques : External chemical vapor deposition – Axial vapor deposition - Internal chemical vapor deposition - Multi element glasses - Phasil system – Comparison of various fabrication processes – drawing and coating – double crucible method – "Rod –in Tube" method.

Plastic fibers: Latest developed types of optical fibers (HPSUV, HPSIR, Halide, Chalcogenide, Tapered fibers) – Mechanism of refractive index variation – Fiber strength – Mechanical Strength measurement of fibers.

UNIT-IV – Fiber losses & Dispersion in optical fibers: 12 hrs

Fiber losses:

Attenuation in optic fibers – Material losses – Rayleigh scattering loss – Absorption loss-Leaky modes – Bending losses – Radiation induced losses – Inherent defect losses – Inverse square law losses – Transmission losses – Temperature dependence of fiber losses – Core and cladding losses.

Dispersion in optical fibers:

Electrical Vs Optical band width – Band width –length product – Dispersion in an optical fiber – Inter – Modal dispersion – Material and material chromatic dispersion – Wave guide dispersion.

Unit – V 12 hrs

Fiber Optic sensors

Fiber Optic sensors – Intensity modulated sensors – Micro band Strain intensity modulated sensor – liquid level type hybrid sensor – Internal effect intensity modulated sensor – Diffraction grating sensors – Sensors using single mode fiber – Interferometry sensors – Interferometry pressure sensor – Interferometry temperature sensor – Polarization problems in Interferometry sensor using single mode sensor – Medical applications of fiber sensor – Electric field and Voltage sensors – Chemical sensors – Magnetic field and current fiber sensors

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for study:

1. G.R.Fowles, Holt, Rincharf and Winstron (1975) Introduction to Modern optics Dower Publications Inc
2. Subir Kumar Sarkar (2010) Optical fibers and fibers optic communication systems, S.Chand Publisher

Books for reference:

1. Born and Wolf (1975) Principles of optics, Pergman Press
2. Stewart D.Perstinick (2009) Fiber optics technology and applications Khanna Publishers
3. N.Subrahmanyam Brijlal and M.N. Avadhanulu (2006) A Text book of Optics, S.Chand Publishers
4. A.B.Gupta (2010) Modern optics, Books and allied publishers, Kolkata, 2nd Edition
5. B.B.Laud (2008) Lasers and non linear optics, New age international, 2nd Edition

PPH11

Course Code: 18PPH103

Mapping					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	H	H	H	S
CO 2	S	S	S	S	H
CO 3	H	M	S	S	S
CO 4	H	S	S	H	S
CO 5	S	S	H	S	H
S- Strong	H-High		M-Medium		L - Low

PPH12

Course Code: 18PPH204

Programme code : 03		**M.Sc Physics**		
Course Code: 18PPH204		**Core Paper 4 – Quantum Mechanics I**		
Batch **2018-2019**	**Semester** **II**	**Hours/Week** **5**	**Total Hours** **75**	**Credits** **4**

Course Objective

1) To impart knowledge on topics of advanced quantum mechanics
2) To understand and to develop problem solving ability on formalism of quant mechanics, energy Eigen value problems and approximation methods.
3) To understand time dependent and independent theories and perturbation theories.

Course Outcome (CO)

K1	**CO1**	After successfully completing the course, students will be able to spot, identify and relate the eigenvalue problems for energy, momentum and angular momentum.
K2	**CO2**	Solutions of the Schrodinger equation for one and three-dimensional potentials, the square well, the harmonic oscillator and algebraic solution of the harmonic oscillator, barrier penetration and the Ramsauer-Townsend effect will be effectively learned.
K3	**CO3**	This course will introduce Dirac's bra-ket formulation of quantum mechanics and make students familiar with various approximation methods.
K4	**CO4**	The students will be able to understand the time-independent and time-dependent perturbation theory, Schrodinger, Heisenberg and Interaction pictures.

UNIT I 15 hrs

General formalism of quantum mechanics

Linear vector space – linear operator – **Eigen values and Eigen functions*** – the Hermitian operator – Postulates of Quantum Mechanics – simultaneous measurability of observables – General Uncertainty relation - Dirac's notation – Equations of motion – Momentum representation – related solved problems

UNIT II 15 hrs

One and three dimensional energy Eigen value problems

Square-well potential with rigid walls – square-well potential with finite walls – square potential barrier – alpha emission – Bloch waves in a periodic potential – Kronig-Penney square-well periodic potential – Linear harmonic oscillator: Schroedinger method

Particle moving in a spherically symmetric potential – spherical harmonics – radial equation – system of two interacting particles – rigid rotator – hydrogen atom – radial equation and its solution – energy eigen values – radial wave functions – wave function of hydrogen like atoms – radial probability density

UNIT III 15 hrs

Angular momenta and their properties

Angular momentum operator in position representation – spin angular momentum – the total angular momentum operators – commutation relations of total angular momentum with components – eigen values of J^2 and J_Z – eigen values of J_+ and J_- - eigen values of J_X and J_Y

Course Code: 18PPH204

– explicit form of the angular momentum matrices – addition of angular momenta: Clebsch Gordan coefficients – properties of Clebsch Gordan coefficients

UNIT IV 15 hrs

Time independent quantum approximation methods

Stationary perturbation theory (non degenerate case) – evaluation of first order energy and evaluation of first order correction to wave function – normal helium atom – stationary perturbation theory : degenerate case – first order Stark effect in hydrogen atom – The variation method – The WKB method – application of WKB method: probability of penetration of a barrier

UNIT V 15 hrs

Time dependent perturbation theory

Time development of states – transition probability: Fermi – Golden rule – adiabatic approximation

The semi-classical treatment of radiation

The Einstein coefficients – The atom – field interaction – spontaneous emission rate – the quantum theory of radiation and its interaction with matter: **quantization of radiation field***

* **Self study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for study:

1. G.Aruldhas (2009) Quantum Mechanics, PHI learning Pvt Ltd
2. Gupta, Kumar and Sharma (2010) Quantum Mechanics , Jai Prakashnath Co., Meerut

Books for Reference

1. P.M. Mathews and K.Venkatesan (2004) A text book of Quantum Mechanics, Tata Mc GrawHill education Pvt. Ltd
2. Leonard. I. Schiff (2002) Quantum mechanics, McGraw Hill Co
3. J J Sakurai, Jim J Napolitino (2014) Modern quantum mechanics Pearson new international
4. Ajoy Ghatak and Lokanathan (2002) Quantum Mechanics: Theory and applications Macmillan India Ltd.

Mapping					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	S	H	H	H
CO 2	H	S	S	S	S
CO 3	H	H	H	H	H
CO 4	S	S	H	S	S
S- Strong	H-High		M-Medium		L - Low

PPH14

Course Code: 18PPH205

Programme code : 03		M.Sc Physics		
Course Code: 18PPH205		Core Paper 5 - Thermodynamics and Statistical Mechanics		
Batch 2018-2019	Semester II	Hours/Week 5	Total Hours 75	Credits 4

Objective: To enable the learner to know about

(i) Basic laws in Thermodynamics,
(ii) Classical law and distributions,
(iii) Basic concepts in quantum statistics.

Course outcome (CO)

K1	**CO1**	Know about statistical nature of concepts and laws in thermodynamics, in particular: entropy, temperature, chemical potential and apply the concepts and principles of black body radiation to analyze radiation phenomena in thermodynamic systems.
K2	**CO2**	Get knowledge about using the statistical Physics methods, such as Boltzmann distribution, Gibbs distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems.
K3	**CO3**	Get knowledge about basic concepts and relations including phase space, ensemble, statistical equilibrium, thermal equilibrium and mechanical equilibrium.
K4	**CO4**	Get knowledge about the statistical mechanics of quantum fluids (bosons or fermions), classical limit and strongly degenerate quantum systems, including Fermi gases and Bose-Einstein condensate

UNIT I: Thermodynamics and Radiation: 15 hrs

Second law of thermodynamics- Entropy and Second law of thermodynamics- Entropy and Disorder- Thermodynamic Potential and Reciprocity relation- Thermodynamic Equilibria - Chemical Potential. Black body radiation – Planck's Radiation law.

UNIT II: Basic Concepts: 15 hrs

Phase space- Volume in phase space-Number of phase cells in given energy range of harmonic oscillator- Number of phase cell in the given energy range of 3-dimensional free particle- Concept of ensemble- Micro canonical ensemble-Canonical ensemble- Grand Canonical ensemble- Density distribution in phase space- Liouvilles theorem- Postulate of equal a priori probability- Statistical equilibrium- Thermal equilibrium- Mechanical equilibrium-Particle equilibrium-Connection between Statistical and thermodynamic quantities.

UNIT III: Classical Distribution Law: 15 hrs

Microstates and Macro states-Classical Maxwell-Boltzmann distribution law- Evaluation of constants, α and β- Maxwell's law of Distribution of velocities- Principle of equi-partition of energy - Connection between the partition function and thermodynamic quantities –Boltzman's entropy relation –Perfect gas in micro canonical Ensembles - Gibbs paradox- Partition function and its correlation with thermodynamics quantities- Partition functions and its properties- Comparison of ensembles

Course Code: 18PPH205

UNIT IV: Quantum Statistics: 15 hrs

Indistinguishability and quantum statistics- Statistical weight and a priori probability- Identical particle's and symmetry requirements - Bose Einstein' Statistics- Fermi Dirac Statistics – Maxwell – Boltzmann statistics **- Comparison of M-B, B-E, and F-D statistics*-** Thermodynamic interpretation of parameter's α and β - Eigen states and the Maxwell Boltzmann equation - Blackbody radiation and Planck radiation- Thermodynamic properties of diatomic molecules Specific heat of solids: Dulong and Pettit's law- Einstein's Theory - Debye theory.

UNIT V: Application of Quantum Statistics: 15 hrs

Ideal Bose Einstein gas:

Energy and pressure of ideal Bose Einstein gas- Gas Degeneracy - Bose Einstein condensation- Thermal properties of Bose Einstein gas-Liquid helium.

Ideal Fermi- Dirac gas:

Energy and pressure of ideal Fermi-Dirac gas – Weak degeneracy – Strong degeneracy at T=0 - Fermi energy –Fermi temperature – Thermodynamic functions of degenerate Fermi - Dirac gas Electron gas - Free electron model and electronic emission.

*** Self study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for Study:

1. Gupta & Kumar (2003) Statistical Mechanics, Pragati Prakashan Meerut
2. Kamal Singh, S.P.Singh ,(1999) Elements of Statistical Mechanics, S.Chand & Co Pvt Ltd

Books for Reference:

1. Keiser Huang,(2009) Fundamentals of Statistical Mechanics
2. F Reif (2010) Fundamentals of Statistical Mechanics and Thermal Physics, McGraw Hill,.

Mapping					
	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	**S**	**S**	**H**	**H**	**S**
CO 2	**S**	**H**	**S**	**H**	**S**
CO 3	**S**	**S**	**H**	**S**	**S**
CO 4	**S**	**H**	**S**	**H**	**S**
S- Strong		**H-High**		**M-Medium**	**L - Low**

PPH16

Course Code: 18PPH206

<table>
<tr><th colspan="2">Programme code : 03</th><th colspan="3">M.Sc Physics</th></tr>
<tr><td colspan="2">Course Code: 18PPH206</td><td colspan="3">Core Paper – 6 : Thin Film Physics, Plasma Physics and Crystal Growth</td></tr>
<tr><td>Batch
2018-2019</td><td>Semester
II</td><td>Hours/Week
4</td><td>Total Hours
60</td><td>Credits
4</td></tr>
</table>

Course Objective

To enable the learners to understand the

1. Preparation and characterization of thin films
2. Fundamentals of plasma Physics
3. Techniques of crystal growth

Course outcome (CO)

K1	**CO1**	Have knowledge on the mechanism and process for the synthesis and evolution of thin films
K2	**CO2**	Be able to understand the principles, advantages and disadvantages of different thin film deposition methods
K3	**CO3**	Be able to the fundamental plasma parameters (under what conditions an ionized gas can be treated as plasma) and to distinguish single particle approach and fluid approach
K4	**CO4**	Be able to understand the physical and chemical processes for the growth of crystals and the different growth techniques

UNIT I **12 hrs**

Methods of preparation of thin films

Nature of thin film- emission conditions- distribution of deposits from point, surface and cylindrical sources – deposition technology- resistive heating- electron beam method- cathodic glow discharge sputtering – chemical vapour deposition-chemical deposition-substrate cleaning.

UNIT II **12 hrs**

Nucleation, Growth and Thickness measurements

Nucleation and growth

Thermodynamis of nucleation – nucleation theories- film growth –incorporation of defects, impurities etc., in thin film –deposition parameters and grain size.

Thickness measurements

Interferometry – Fringes of equal thickness (FET) – Fringes of equal chromatic order (FECO) – Step gauges - Ellipsometry – Stylus profilometry - Vibrating quartz crystal method - Gravimetric balance method

UNIT III **12 hrs**

Plasma state - Characterization

Occurrence of plasma in nature- definition of plasma –concept of temperature-Debye shielding –plasma parameters- criteria for plasma – single particle motion: uniform B field –uniform E and B fields- Gravitational field –**non uniform B field*** –curved B –magnetic mirrors

Course Code: 18PPH206

UNIT IV **12 hrs**

Fluid theory and Application of Plasma

Derivation of fluid equation of motion - fluid drifts perpendicular to B- fluid drifts parallel to B
Application of Plasma Physics: Production of nano particles by plasma-Plasma nitriding – Plasma sources for hospital waste-Plasma treatment of textiles.

UNIT V **12 hrs**

Crystal growth

Growth from liquid solution: Aqueous solution growth – Holden's rotary crystallizer- Mason jar method - temperature differential methods- chemical reactions – sol gel growth – liquid crystal (preliminary ideas only).
Hydrothermal growth: Modified Bridgemann hydrothermal autoclave- Morley hydrothermal autoclave – phase equilibria and solubility- kinetic quartz.

*** Self-study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for study:

1. A.Goswami (2006) Thin film fundamentals, New age international (P) Lt.,
2. Francis F.Chen (1984), Introduction to Plasma Physics and controlled fusion, Plenum Press, New York
3. P.I. John (2005) Plasma Sciences and the creation of wealth, Tata McGraw Hill Publishing Company Limited
4. J.C.Brice (1986) Growth of Crystal from liquids, Blackie & Sons Pub.,
5.

Books for Reference:

1. L.T. Meisssel and R.Glang (1978) Hand book of thin film Technology, McGraw Hill
2. A. Krall and Alvin W.Trivelpiece (1982) Principles of Plasma Physics Nichola, McGraw Hill Publications
3. K.L.Chopra, (1979) Thin Film Phenomena, Robert E. Krieger Publishing Company
4. Milton Ohring (2001) Materials Science of Thin Films, Academic Press

Mapping					
	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**S**	**H**	**S**	**H**	
CO 2	**S**	**H**	**H**	**S**	**S**
CO 3	**H**	**S**	**S**	**S**	**H**
CO 4	**S**	**H**	**H**	**H**	**S**
S- Strong	**H-High**		**M-Medium**		**L - Low**

PPH18

Course Code: 18PPH207

Programme code : 03		M.Sc Physics		
Course Code: 18PPH207		Core Paper 7 - Nuclear and Particle Physics		
Batch 2018-2019	Semester II	Hours/Week 4	Total Hours 60	Credits 4

Course Objective

To study about the

1. Basic nuclear structure
2. Radio - Alpha decay, Beta decay and Gamma decay
3. Nuclear Models: Liquid Drop Model, Shell Model

Course Outcome (CO)

K1	**CO1**	Be able to study the structure of a nucleus and about nuclear forces
K2	**CO2**	Be able to understand the various types of decays in radioactive elements
K3	**CO3**	Have a thorough knowledge of the different nuclear models and different types of nuclear reactions
K4	**CO4**	A thorough knowledge about elementary particles

UNIT I **15 hrs**

Basic Nuclear Structure

Distribution of nuclear charge – Nuclear mass – Mass spectroscopy – Bain bridge and Jordan, Nier Mass spectrometer* – Theories of nuclear compositions (proton-electron, proton-neutron) – Bound states of two nucleons – spin states – Paulis's exclusion principle — Tensor force – Static force – Exchange force – Low energy nucleon- nucleon scattering

UNIT II **15 hrs**

Radioactivity

Alpha decay: Properties of α particles – Velocity and energy of α particles – Gamow's theory of α decay – α – ray energies and fine structure of α rays - long range α particles.

Beta Decay: Properties of β particles – General features of β rays Spectrum – Pauli's hypothesis – Fermi's theory of β decay – Forms of interaction and selection rules – Fermi and Gamow Teller transitions.

Gamma decay: Interaction of γ rays with matter - measurement of γ rays energies – DuMond bent Crystal spectrometer method – internal conversion.

UNIT III **15 hrs**

Nuclear Models

Liquid drop model: Bohr Wheeler theory of fission – condition for spontaneous fission – activation energy - Seaborg's Expression.

Shell Model: Explanation of magic numbers – prediction of shell model – prediction of nuclear spin and parity – Nuclear statistics – Magnetic moment of nuclei - Schmidt lines – nuclear isomerism.

Collective model: Explanation of quadrupole moments – prediction of sign of electric quadrupole moments.

Optical Model: Nelson Model – Elementary ideas.

Course Code: 18PPH207

UNIT IV **15hrs**

Nuclear Reaction

Kinds of reactions and conservation laws – Energies of Nuclear reaction – reaction cross section – continum theory of Nuclear reaction – resonance – Briet Wigner Dispersion formula – Stages of a Nuclear reaction – statistical theory of nuclear reaction – Evaporation probability and Cross reaction – **kinematics of stripping and pickup reaction*.**

UNIT V **15 hrs**

Particle Physics

Hadrons – Hyperons – Pion – Meson resonances – strange mesons and Baryons – Gellmann Okuba mass formula for Baryons – CP violation in K decay – Quark model – Reaction and decays – quark structure of Hadrons.

***Self study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for study:

1. R.C. Sharma (2004) Nuclear Physics, K. Nath & Co., Meerut
2. D.C.Tayal (2002) Nuclear Physics, Himalayan Publishing House, Bombay
3. Yadav and Pandya (2000) Elements of Nuclear Physics, K.Nath Ram Nath Co.,

Books for Reference:

1. Bernard L. Cohen (2004) Concept of Nuclear Physics, Tata Mc Graw Hill Publishing
2. Kenneth S. Karne (1998) Introduction of Modern Physics, John Hile and Sons, New York
3. R.Murugesan (1999) Nuclear Physics, S. Chand and Co.

Mapping					
	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**S**	**H**	**S**	**H**	
CO 2	**S**	**H**	**H**	**S**	**S**
CO 3	**H**	**S**	**S**	**S**	**H**
CO 4	**S**	**H**	**H**	**H**	**S**
S- Strong	**H-High**		**M-Medium**	**L - Low**	

PPH20

Course Code: 18PPH2CL

Programme code : 03		**M.Sc Physics**		
Course Code: 18PPH2CL		**Core Practical I – General Experiments**		
Batch **2018-2019**	**Semester** **I & II**	**Hours/Week** **4**	**Total Hours** **120**	**Credits** **3**

Course Objective

To enable the learners to

1. Perform experiments in the field of general Physics and gaining physical understanding of the results.
2. Explain physical phenomena and enable to relate physical laws and their applications and hence have a good foundation in Physics.
3. Will be able to apply standard techniques and assess the experimental result and output.

Course outcome (CO)

K5	**CO1**	Have a good foundation in the fundamentals and applications of general Physics
K5	**CO2**	Able to design, carry out record and analyze experimental data.
K5	**CO3**	Provide hands on experiences in conducting scientific investigations and laboratory experiments.
K5	**CO4**	Understand the relationship between theory and experimental results.

List of Experiments <u>(Any Twelve)</u>

1. Young’s modulus-Elliptical fringes (Cornu’s method)
2. Young’s modulus-Hyperbolic fringes- (Cornu’s method)
3. Viscosity of a liquid-Mayer’s oscillating disc
4. Stefan’s constant
5. Rydberg’s constant- solar spectrum
6. Thickness of insulation using laser source
7. Determination of audio frequencies -Wien Bridge method
8. Coefficient of Self-inductance of a coil by Anderson’s bridge method.
9. Forbes method-Thermal conductivity
10. e/m by Millikan’s method
11. e/m by Thomson’s method
12. TCR and band gap energy of thermistor- Carey Foster’s Bridge
13. Ferguson’s method-specific heat of liquid
14. Biprism of optical bench-Determination of wavelength
15. Planck’s Constant – Photoelectric emission
16. Hysteresis loss by CRO
17. Diffraction at a prism table- determination of wavelength
18. Determination of Dielectric constant of a liquid
19. Determination of wavelength of laser source- transmission grating
20. Determination of refractive index of a liquid by Air Wedge method

Course Code: 18PPH2CL

21. Determination of refractive index of a liquid by Newtons ring method
22. Laser – Determination of refractive index of given liquids
23. Study of thermolumnescence of F-centres
24. Determination of electron Spin - Stern Gerlac Experiments
25. Fizeau's Method – Liner expansion

Mapping					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	H	H	S	H
CO 2	H	S	S	H	S
CO 3	S	H	S	S	H
CO 4	S	H	S	H	H
S- Strong	H-High		M-Medium		L - Low

PPH22

Course Code: 18PPH2CM

Programme code : 03		**M.Sc Physics**		
Course Code: 18PPH2CM		**Core Practical II – Electronics Experiments**		
Batch **2018-2019**	**Semester** **I & II**	**Hours/Week** **4**	**Total Hours** **120**	**Credits** **3**

Course Objective

To enable the learners to

1. To design and construct small electronic circuits
2. To develop experimental skills and understand relation between experimental data and theoretical analysis.
3. Have a good foundation in the fundamentals and applications of experimental Physics

Course outcome (CO)

K5	**CO1**	Acquire a basic knowledge in solid state electronics including FET, UJT and OP AMP.
K5	**CO2**	Develop the ability to analyse and design analog electronic circuits using discrete components.
K5	**CO3**	Observe the amplitude frequency response of common amplification circuits.
K5	**CO4**	Take measurements to compare experimental results in the laboratory with the theoretical analysis.

List of Experiments (Any Twelve)

1. Construction of dual regulated power supply
2. Parameters of Op-Amp
3. Triangular wave generator
4. Square wave generator
5. Wien's Bridge Oscillator
6. Active filters using Op-Amp
7. Schmitt Trigger using Op-Amp
8. Astable Multivibrator using Op-Amp
9. Phase- Shift Oscillator using Op-Amp
10. Clipping circuits
11. Clamping circuits
12. Differentiating and integrating circuits
13. Characteristics of Photo diode and Photo Transistor
14. Characteristics of Tunnel Diode
15. Characteristics of SCR
16. Characteristics of UJT
17. UJT relaxation oscillator
18. FET - common source amplifier
19. FET - common drain amplifier
20. Direct Coupled Amplifier
21. Characteristics of MOSFET
22. Characteristics of DIAC & TRIAC
23. Study of Pulse width modulation

Course Code: 18PPH2CM

Mapping					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	H	H	S	H
CO 2	H	S	S	H	S
CO 3	S	H	S	S	H
CO 4	S	H	S	H	H
S- Strong	H-High		M-Medium		L - Low

PPH24

Course Code: 18PPH308

Programme: 03		M.Sc. Physics		
Course Code: 18PPH308		Core Paper 8 - Quantum Mechanics – II		
Batch **2018-2019**	**Semester** **III**	**Hours/Week** **5**	**Total Hours** **75**	**Credits** **5**

Course Objective

To enable the learners to

1. Understand the basic approximate methods in molecular Quantum Mechanics
2. Understand relativistic quantum theory, quantum optics and quantization of fields and scattering

Course outcome (CO)

K1	**CO1**	Understand different approximations and models to describe a many electron system
K2	**CO2**	Comparison of MO and VB theories to explain molecular structre of hydrogen molecule and hydrogen ion
K3	**CO3**	Understand the relation between relativistic theory and quantum mechanics through Dirac's and the related theories. The understandability of spin and negative energy states will be clear.
K4	**CO4**	Interpret scattering theory interms of quantum aspects.

UNIT I **12 hrs**

Many electron atoms:

Indistinguishable particles – Pauli principle – Inclusion of Spin – Spin functions for two electrons - Spin functions for three electrons – The Helium atom – Central Field approximation – Thomas-Fermi model of the atom – Hartree Equation

UNIT II **12 hrs**

Molecular structure:

The Born Oppenheimer Approximation – Molecular orbital theory (LCAO approximation) - Hydrogen molecule Ion – Hydrogen molecule (The MO method) - The valence bond (VB method) – Comparison of MO and VB theories

UNIT III **12 hrs**

Relativistic Quantum mechanics:

Klein Gordan equation – Interpretation of the Klein Gordan equation – Particle in a coulomb field – Dirac's equation for a free particle – Dirac Matrices – Covariant form of Dirac's equation - Probability density – plane wave solution - Negative energy states – spin of the Dirac particle – Magnetic moment of the electron – Spin- Orbit Interaction.

UNIT IV **12 hrs**

Quantum field theory:

Concept of Field and Second Quantization - Quantization of wave field –Lagrangian & Hamiltonian density – Lagrangian & Hamiltonian field equations – Quantum Canonical equations - Quantum equations for the non relativistic Schrödinger equation - Creation, destruction and number operators – anti commutation relations (basic concepts) – **Quantization of electromagnetic field***

UNIT V **12 hrs**

Quantum theory of scattering

Scattering cross-section – scattering amplitude – Partial waves – Scattering by a central potential: Partial wave analysis – Significant number of partial waves - The Born approximation – scattering by a screened coulomb potential – Validity of Born approximation.

*** Self study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for study:

1. G Aruldhas, (2009), Quantum Mechanics, PHI learning Pvt Ltd, II Edition
2. A.K.Chandra (2010), Introductory Quantum Chemistry, TataMcGrawHill 4th Edition
3. Gupta. Kumar.Sharma, (2010), Quantum Mechanics, Jai Prakash Nath & Co. 29th Edition

Books for reference:

1. B.H.Bransden and C.J.Joachain, (1983), Physics of atoms and molecules, Longman Publication,
2. A.K.Ghatak and Loganathan, (2002), Quantum Mechanics, McMillan & Co., IV Edition,
3. P. M. Mathews and K.Venkatesan, (2004), A text book of Quantum Mechanics, TATA Mc Graw Hill,
4. Ira N.Levine, (1999), Quantum Chemistry, Prentice Hall, International Inc
5. Lenard I Schiff (2002), Quantum Mechanics, Tata Mc Graw Hill, New Delhi III Edition.

Mapping					
	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**S**	**H**	**H**	**H**	**S**
CO 2	**H**	**H**	**H**	**S**	**H**
CO 3	**S**	**S**	**S**	**H**	**S**
CO 4	**S**	**H**	**H**	**S**	**S**
S- Strong	**H-High**		**M-Medium**		**L – Low**

Course Code: 18PPH309

Programme: 03		M.Sc Physics		
Course Code: 18PPH309		Core Paper 9 – Electromagnetic Theory and Electrodynamics		
Batch 2018-2019	Semester III	Hours/Week 5	Total Hours 75	Credits 5

Course Objective

To know about

1. Theoretical study on electrostatics and magneto statics
2. Applications of Maxwell's equations
3. Antenna Arrays

Course outcome (CO)

K1	**CO1**	Understanding of Maxwell's equations and will be able to manipulate and apply them to EM problems
K2	**CO2**	Define and derive expressions for energy of electrostatics and magnetostatics fields and derive Poynting's theorem
K3	**CO3**	Understanding of the propagation and losses of electromagnetic waves in different media.
K4	**CO4**	Study the interaction of electromagnetic waves with different media

UNIT I **12 hrs**

Electrostatics

Dielectric polarization – external field of a dielectric medium – the electric displacement vector, D- linear dielectrics – relation connecting electric susceptibility – P, D and dielectric constant – Molecular field and Clasius – Mosotti relation for non polar molecules – Langevin – Debye formula for polar molecules - **Electrostatic energy and energy density*.**

Magnetostatics

Biot - Savart law statement – Lorentz force law and definition of B – general proof of Ampere's Circuital law – divergence and curl of B – magnetic scalar potential (derivation of expression only) – equivalence of a small current loop and a magnetic vector potential (derivation of expression only).

UNIT II **12 hrs**

Field equation and conservation laws:

Equation of continuity – displacement currents – The Maxwell's equations derivation – Physical significance – Poynting vector – momentum in electro magnetic field- electro magnetic potentials- Maxwell's equation in electro magnetic potentials- concept of gauge – Lorenz gauge-Coulomb gauge radiation produced by a low velocity accelerated charged particle (Larmour formula)- oscillating electric diode- radiation due to small current – linear half wave antenna **- antenna array***

Course Code: 18PPH309

UNIT III **12 hrs**

Propagation of electromagnetic waves:

Electromagnetic waves in free space – poynting vector of free space (energy flow) plane electromagnetic waves in matter – isotropic dielectric,–in conducting media – poynting vector in conducting media- propagation in ionized gases.

Interaction of EMW with matter on microscopic scale:

Scattering and scattering parameters- scattering by a free election (Thomson scattering) – scattering by a bound electron (Rayleigh scattering) – dispersion in gases – normal and anamolous dispersion in liquids and solids.

UNIT IV **12 hrs**

Interaction of EMW with mater on macroscopic scale:

Boundary conditions at interfaces – reflection and refraction- Frenel's law-Brewster;s law and degree of polarization – total internal reflection and critical angle-reflection from a metal surface- Wave guide(Rectangular) – TE waves – TM waves.

UNIT V **12 hrs**

Relativistic Electrodynamics:

Four vectors – Transformation relation for charge and current densities-for electromagnetic potentials – covariant form of inhomogenous wave equations-covariance of field equation in terms of four vectors –covariant form of electric and magnetic field equations – covariance of electromagnetic field tensor –transformation relation or field vector E and B – covariance form of Lorentz force law.

* **Self study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for study:

1. Chopra & Agarwal, (2010), Electromagnetic theory, K.Nath & Co. 5th edition,
2. Gupta Kumar& Singh, (2005), Electromagnetics, Pragathi Prakashan, Meerut.

Book for Reference:

1. Sathya Prakash, Kedar Nath, (2008), Electromagnetic theory and Electrodynamics, Ram Nath & Co.,10th Edition,

Mapping					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	H	S	H	H	A
CO 2	H	S	S	S	H
CO 3	S	H	H	H	H
CO 4	H	S	H	H	S
S- Strong	H-High		M-Medium		L – Low

Course Code: 18PPH310

Programme: 03		M.Sc Physics		
Course Code: 18PPH310		Core paper 10 - Solid State Physics		
Batch 2018-2019	Semester III	Hours/Week 5	Total Hours 75	Credits 5

Course Objective

To impart knowledge on

i) The different symmetry phases and structures that occur in native
ii) Different types of defects, dislocations in crystals
iii) Various physical properties of crystalline solids

Course Outcome (CO)

K1	**CO1**	Knowledge on structural, semiconducting, superconducting and magnetic properties of crystalline materials
K2	**CO2**	Understand the imperfections in crystals and also lattice vibrations
K3	**CO3**	Knowledge on characterization of semiconducting and superconducting materials
K4	**CO4**	Analyze the effect of temperature, impurity concentration on electrical and magnetic properties of various materials.

UNIT I **12 hrs**

Crystal Structure and Reciprocal lattice

Symmetry elements – Space lattice: Three dimensional lattice types – Interplanar distance (spacing of lattice plains) – Separation between lattice plains in simple cubic, fcc and bcc lattices. Lattice constant and density – Hexagonal closed packed structure (qualitative)- Diamond structure – **Sodium chloride* – Cesium chloride structure*** – The reciprocal lattice- Graphical construction and vector development – Properties of the reciprocal lattice – Bragg condition in terms of the reciprocal lattice.

UNIT II **12 hrs**

Imperfections in crystal

Classification of imperfections – crystallographic imperfections: point defects – Frenkel defects – colour centers – F Centers – Other centres in alkali halides – Line defects: Definitions of dislocations – Plastic deformation – Shear strength of single crystals – Edge dislocations – Screw dislocations – Burger's vector – Stress fields around dislocations.

UNIT III **12 hrs**

Lattice vibrations; semiconductors, dielectrics

Lattice vibrations: The linear diatomic lattice – Excitation of optical branch in ionic crystals – The IR absorption – Localized vibrations – Quantization of Lattice vibrations – Phonon momentum.

Semiconductors: Intrinsic semiconductors – Band model- electron and hole concentrations – Law of mass action – Electrical conductivity – Extrinsic semiconductors – Impurity state and Band model – electron and hole concentrations – Impurity electrical conductivity.

Course Code: 18PPH310

Dielectrics: Ferroelectricity – Theories of Ferroelectricity – **Applications of Ferroelectrics*** – Ferroelectricity versus Piezoelectricity – Anti ferroelectricity.

UNIT IV **12 hrs**

Superconductivity

Introduction – Thermal properties – The Energy gap – Isotope effect – Type I and Type II superconductors – London equations (electrodynamics) – Superconductors in AC fields – Thermodynamics of superconductors – BCS theory – BCS Ground state – Quantum tunneling – Josephson's tunneling – Theory of D.C.Josephson Effect – AC Josephson effect

Practical Applications of superconductivity: Low temperature superconductors – High temperature superconductors – SQUIDS

UNIT V **12 hrs**

Magnetism

Diamagnetism – Classical theory – Quantum theory – Paramagnetism – Classical theory – Quantum theory – Ferromagnetism – Spontaneous magnetization. Weiss theory of spontaneous magnetization – Hysteresis – Weiss theory of Hysteresis – Ferromagnetic domains – Antiferromagnetism – Molecular field theory – Susceptibility above and below Neel temperature – Ferrimagnetism – Molecular field theory of Ferrimagnetism.

***Self study**

Teaching Methods: Power Point Presentation / Seminar / . / Discussion / Assignment

Books for study:

1. S.L Gupta and Kumar, (2005), Solid State Physics, V.K. Nath and Co., Meerut
2. R.L.Singhal ,Kedar Nath, (2005), Solid State Physics, Ram Nath and Co., Meerut

Books for reference:

1. S.O.Pillai, , (2006), Solid State Physics, , New Age International Pub III Edition
2. R.K.Puri, V.K.Babbar, (2001), Solid State Physics S.Chand & Co.,

Mapping					
	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**S**	**H**	**H**	**S**	**H**
CO 2	**H**	**S**	**S**	**H**	**S**
CO 3	**S**	**H**	**S**	**S**	**H**
CO 4	**S**	**H**	**S**	**H**	**H**
S- Strong	**H-High**		**M-Medium**		**L - Low**

PPH30

Course Code: 18PPH411

Programme: 03		M.Sc Physics		
Course Code: 18PPH411		Core paper 11 - Communication Physics		
Batch 2018-2019	Semester IV	Hours/Week 5	Total Hours 75	Credits 4

Course Objective

To enable the learners to understand
1. Various modulation and detection techniques
2. Generation and propagation of microwaves
3. Radar and communication electronics

Course Outcome (CO)

K1	**CO1**	Knowledge about wireless and wired telephony communication systems
K2	**CO2**	Understand the working principles of Radio, Television, Radar and Satellite communication
K3	**CO3**	Knowledge on modeling of different types of antennas and microwave generation
K4	**CO4**	Able analyze the problems involved in designing of wireless communications devices

UNIT I **15 hrs**
Modulation and Detection
Need for modulation - Principles of AM and FM with circuit diagrams – Comparison of DSB, SSB, DSBSC and VSB transmission – Multichannel communications (FDM, TDM) – AM detection – Frequency discriminator and ratio detector.

UNIT II **15 hrs**
Antennas and Wave Propagation
The elementary doublet - Terms and definitions in connection with antennas and their radiation patterns – Effect of ground on antennas – Effect of antenna height - Antenna coupling at medium frequencies - Dipole arrays – Broad side and End fire array - Wide band and special purpose antennas, Folded dipoles, helical antenna, discose antenna and phased arrays – Ground wave propagation - Sky wave propagation **- Magneto - ionic Theory***

UNIT III **15 hrs**
Television and Radar
Black and White TV Transmission – Black and White TV Reception – Color TV Transmission and Reception - Elements of a RADAR system – The RADAR equation – Radar performance factors – Radar Transmitting systems – Radar Antennas - Duplexers - Radar Receivers and Indicators – Pulsed systems

Course Code: 18PPH411

UNIT IV **15 hrs**

Communication Electronics

Fundamentals of Data Communication systems – Data Sets and interconnection requirements – Network and control considerations – Multiplexing – Short and Medium Haul systems – Long Haul systems – Elements of Long distance Telephony – Satellite communication – **Features of a communication network –TYMNET, ARPANET, ISDN, LAN***

UNIT V **15 hrs**

Microwaves

Microwave generation – Multicavity Klystron -Reflex Klystron – Magnetron, TWT and other microwave tubes - Microwave transistors – Microwave integrated circuits – Parametric Amplifiers – MASER – Tunnel Diode – Gunn Diode.

* **Self study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for study:

1. George Kennedy Davis, (2008), Electronics Communication systems , Tata McGraw Hill 4th Edition, New Delhi.
2. Anokh Singh & A.K.Chhabra, (1999), Principles of Communication Engineering S.Chand and Co.,
3.

Books for Reference:

1. F.E. Terman, (1957), Electronics and Radio Engineering, McGraw Hill, 4th Edition
2. Simon Haykin, (2010), Communication systems, John Wiley and Son Inc. 5th Edition

Mapping					
	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**S**	**H**	**H**	**S**	**H**
CO 2	**H**	**S**	**S**	**H**	**S**
CO 3	**S**	**H**	**S**	**S**	**H**
CO 4	**S**	**H**	**S**	**H**	**H**
S- Strong	**H-High**		**M-Medium**		**L - Low**

Course Code: 18PPH412

Programme: 03		M.Sc Physics		
Course Code: 18PPH412		Core Paper 12 - Atomic and Molecular Spectroscopy		
Batch 2018-2019	Semester IV	Hours/Week 5	Total Hours 75	Credits 4

Course Objective

To study about the

1. Atomic Spectroscopy, Microwave Spectroscopy, IR Spectroscopy and Raman Spectroscopy
2. Electronic Spectra of diatomic molecules
3. NMR and AQR Spectroscopy.

Course outcome (CO)

K1	**CO1**	Explain the different spectroscopic methods for qualitative and quantitative analysis
K2	**CO2**	Explain electronic transitions, atomic spectra, excited states, hydrogenic and multielectron atoms.
K3	**CO3**	Understanding of quantum chemical principles
K4	**CO4**	Knowledge about binding of atoms into molecules, molecular degrees of freedom (electronic, vibrational and rotational) and elementary group theory.

UNIT I **12 hrs**

Atomic spectroscopy

Spectra of the alkali metal vapours– Elements with more than one outer valence electron – magnetic moment and space quantization of angular momentum– The magnetic moment of the atom – Normal Zeeman effect – Anamalous Zeeman effect– Emitted transitions in anomalous Zeeman transitions – The Lande's 'g' formula – The Paschen Back effect – hyperfine structure of spectral line – Zeeman effect of hyperfine structure – the Back-Goudsmit effect.

UNIT II **12 hrs**

Microwave Spectroscopy

The rotation of molecules – rotational spectra of rigid diatomic molecules – the intensities of spectral lines – the non rigid rotator – the spectrum of a non-rigid rotator – symmetric top molecules

IR Spectroscopy

The vibrating diatomic molecules – The simple harmonic oscillator – The anharmonic oscillator – The diatomic vibrating rotator – fundamental vibrations and their symmetry – The influence of rotation on the vibrational spectra of polyatomic molecules – linear molecules – symmetric top molecules.

Unit III **12 hrs**

Raman spectroscopy

Quantum theory – Classical theory – pure rotational Raman spectra – linear molecules – symmetric top molecules – Raman activity of vibrations – Rule of mutual exclusion – Vibrational Raman spectra – Rotational fine structure

Course Code: 18PPH412

Electronic spectra of diatomic molecules
Vibrational coarse structure – Deslandres tables – Frank-Condon principle – rotational fine structure of electronic – vibrational transition

UNIT IV **12 hrs**
NMR spectroscopy:
Quantum mechanical and classical description – The Bloch equations - Relaxation processes- spin lattice and spin relaxation – Fourier transformation - Experimental technique- principles and working of Fourier transform NMR spectrometer- chemical shift.
NQR spectroscopy:
Fundamental requirements - general principles – Half integral spins – Integral spins experimental detection of NQR frequencies.

UNIT V **12 hrs**
ESR Spectroscopy:
Basic principles of ESR – experiments - ESR Spectrometer - Reflection cavity and microwave bridge – ESR spectrum- **Hyperfine structure – Study of free radicals*.**
Mossbauer Spectroscopy:
The Mossbauer effect – The recoilless emission and adsorption – The Mossbauer spectrum- experimental methods.

*** Self study**

Teaching Methods: Power Point Presentation / Seminar / . / Discussion / Assignment

Books for study:

1. C.N. Banwell and E.M.McCash, (1994), Fundamentals of Molecular Spectroscopy Tata McGraw Hill Pub.Co4th Edition.
2. B.P.Straughan and S.Walker, (1976), Spectroscopy, John Wiley & Sons Inc., Newyork.

Books for Reference:

1. Gupta Kumar, (2007), Elements of spectroscopy Pragathi Prakasan pub.Co., Meerut
2. G.Aruldhas, (2002), Molecular structure and spectroscopy, Prentice Hall of India.

Mapping					
	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**S**	**H**	**H**	**S**	**H**
CO 2	**H**	**S**	**H**	**H**	**H**
CO 3	**H**	**S**	**H**	**H**	**S**
CO 4	**S**	**H**	**S**	**H**	**H**
S- Strong	**H-High**		**M-Medium**		**L - Low**

Course Code: 18PPH4CN

<table>
<tr><td colspan="2">Programme: 03</td><td colspan="3">M.Sc. Physics</td></tr>
<tr><td colspan="2">Course Code: 18PPH4CN</td><td colspan="3">Core Practical III – Advanced Experiments</td></tr>
<tr><td>Batch
2018-2019</td><td>Semester
III & IV</td><td>Hours/Week
5</td><td>Total Hours
150</td><td>Credits
3</td></tr>
</table>

Course Objective

To enable the learners to

1. Perform experiments in the field of advanced Physics and interpret the results.
2. Explain physical phenomena and enable to estimate various related parameters and to analyze them.
3. Apply the experimental techniques to the research level

Course outcome (CO)

K5	**CO1**	Fundamental knowledge on applications of advanced Physics.
K5	**CO2**	Understand the relationship between theory and experiments
K5	**CO3**	Provide hands on experiences in conducting scientific investigations and laboratory experiments.
K5	**CO4**	Design, carry out record and analyze experimental data.

List of Experiments (Any Fifteen)

1. Development of Copper/Brass/Iron Arc spectra – Constant Deviation Spectrograph
2. Magnetic field Strength determination – Search Coil method
3. Determination of Magnetic Susceptibility of the given solutions – Quincke's method
4. Determination of Magnetic Susceptibility of the given solutions – Guoy's method
5. Compressibility of a liquid – Ultrasonic diffraction
6. Hall Effect- Measurement of Hall parameters.
7. e/m – Zeeman effect
8. e/m – Magnetron method.
9. e/m – Helical method
10. B-H curve - Anchor ring
11. B-H curve - Solenoid
12. I-H curve - Solenoid
13. Kelvin's double Bridge – Determination of very low resistance and specific resistance of different metals.
14. Determination of Planck's constant - Photo Cell.
15. To determine the resistivity of a Semiconductor material - Four Probe method.
16. Determination of Dielectric Constant of a liquid and Dipole moment of an Organic molecule using Capacitance Measurement Circuit.
17. Crystal growth – Growing crystals by different methods.
18. Michelson interferometer – determination of λ, $d\lambda$ and thickness of mica sheet.

Course Code: 18PPH4CN

19. G.M Counter
20. Fiber optic Experiments - Determination of Numerical aperture, acceptance angle and Fiber Loss of an optical fiber
21. Determination of Dielectric constant (for solid)
22. X-ray Diffraction – Structural analysis (Quantitative)
23. Thin Film – Material coating by Sol Gel method / Co-precipitation method
24. Optical bench – Biprism

Mapping					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	S	H	S	H
CO 2	H	S	S	H	S
CO 3	S	H	S	S	H
CO 4	S	H	S	H	H
S- Strong	H-High		M-Medium		L - Low

PPH36

Course Code: 18PPH4CO

Programme: 03		M.Sc. Physics		
Course Code: 18PPH4CO		Core Practical IV – Special Electronics Experiments		
Batch 2018-2019	Semester III & IV	Hours/Week 5	Total Hours 150	Credits 3

Course Objective

To enable the learners to

1. To design and construct small electronic circuits
2. To develop experimental skills and understand relation between experimental data and theoretical analysis.
3. Have a good foundation in the fundamentals and applications of experimental Physics

Course outcome (CO)

K5, K6	CO1	Acquire a basic knowledge in solid state electronics including OP AMP and 555 timer and understand the ALP using 8085 processor
K5, K6	CO2	Develop the ability to analyze and design analog electronic circuits using discrete components.
K5, K6	CO3	Observe the physical entities by constructing a sensor circuits such as temperature and light intensity using Op-amp
K5, K6	CO4	Take measurements to compare experimental results in the laboratory with the theoretical analysis and also simulate the ALP for the interfaces such as Traffic control, Stepper motor and A/D, D/A converters

List of Experiments (Any Fifteen)

1. Op. amp - V to I & I to V converters.
2. Op. amp - D/A converter-Binary weighted, Ladder methods
3. Op. amp - Log and Antilog amplifiers.
4. Op. amp - Half wave, Full wave & Peak value Clippers and Clampers
5. Op. amp - Comparator-Zero crossing detectors, Window detector, Time marker.
6. Op-amp- Simultaneous Addition and Subtraction
7. Op amp -Analog Computations - Simultaneous Equations
8. Op amp -Analog Computations - First order differential Equations
9. Op-amp-Instrumentation amplifier-Temperature measurement
10. Op-amp- Instrumentation amplifier-Light intensity-Inverse square law
11. 555 Timer -Schmitt trigger & Voltage controlled oscillators
12. 555 Timer - Monostable & Astable multivibrators
13. Study of Flip Flops
14. Study of Shift Registers
15. Study of Johnson and Ring Counters
16. Study of Synchronous Counters
17. Study of Asynchronous Counters

Course Code: 18PPH4CO

18. Study of Semiconductor Memory - ROM
19. Microprocessor - LED interfacing (Rolling display)
20. Microprocessor - Stepper motor interfacing
21. Microprocessor - Traffic control simulation
22. Microprocessor - ADC interface
23. Microprocessor – DAC - Wave form generator
24. Microprocessor - Hex key board interfacing
25. Microprocessor - Musical tone generator
26. Microprocessor - Temperature controller

Mapping					
	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**S**	**H**	**H**	**S**	**H**
CO 2	**H**	**S**	**S**	**H**	**S**
CO 3	**S**	**H**	**S**	**S**	**H**
CO 4	**S**	**H**	**S**	**H**	**H**
S- Strong	**H-High**		**M-Medium**		**L - Low**

Course Code: 18PPH4Z1

<table>
<tr><th colspan="2">Programme: 03</th><th colspan="3">M.Sc. Physics</th></tr>
<tr><th colspan="2">Course Code: 18PPH4Z1</th><th colspan="3">Project Work and Viva-Voce</th></tr>
<tr><th>Batch
2018-2019</th><th>Semester
IV</th><th>Hours/Week
5</th><th>Total Hours
150</th><th>Credits
5</th></tr>
</table>

Marks Distribution

<table>
<tr><th>CIA/ESE</th><th>Particulars</th><th>Marks</th></tr>
<tr><td rowspan="3">CIA</td><td>Project Review</td><td>30</td></tr>
<tr><td>Regularity</td><td>10</td></tr>
<tr><td>Total Internal Marks</td><td>40</td></tr>
<tr><td rowspan="3">*ESE</td><td>Project Report Presentation</td><td>120</td></tr>
<tr><td>Viva Voce</td><td>40</td></tr>
<tr><td>Total External Marks</td><td>160</td></tr>
<tr><td colspan="2">Total Marks (CIA + ESE)</td><td>200</td></tr>
</table>

* Projects report and Viva voce will be evaluated jointly by Project Supervisor and an External Examiner.

MAJOR ELECTIVE PAPERS

(2 papers are to be chosen from the following 4 papers)

1. **Nanotechnology: Principles and Applications**
2. **Atmospheric Science**
3. **Biomedical Instrumentation**
4. **Problems in Physics**

PPH40

MAJOR ELECTIVE PAPER: 1

Course Code:

Programme: 03		**M.Sc Physics**		
Course Code:		**Nanotechnology Principles and Applications**		
Batch 2018-2019	**Semester**	**Hours/Week 5**	**Total Hours 75**	**Credits 5**

Course Objective

To impart knowledge on

i) To understand the nanomaterial and nanotechnology
ii) To know the different synthesis processes for making nanomaterials
iii) To know the characterization techniques available for nanomaterials
iv) To explore the nano-devices and various applications

Course Outcome (CO)

K1	**CO1**	Understand the basic concepts of nanoscience, physical principles of quantum confinement and classification of nanostructures.
K2	**CO2**	Know the synthesis methods of 0-D, 1-D, 2-D and 3-D nanomaterials and its own advantages.
K3	**CO3**	Know the various characterization methods to study material's morphological, structural and optical properties.
K4	**CO4**	Gain knowledge in the applications of nanotechnology in the field of data storage, biology solar cell, sensor and rechargeable batteries.

UNIT I **12 hr**

Physical concepts in Nanomaterials

Classification of nanomaterials – Quantum confinement in semiconductor nanostructures: quantum well, quantum wires and quantum dots : Electronic density of states, Surface to volume ratio versus shape, The quantum Hall effect - Resonant tunneling - Interband absorption in semiconductor nanostructures - Intraband absorption in semiconductor nanostructures - Light emission processes in nanostructures - The phonon bottleneck in quantum dots - The quantum confined Stark effect - Non-linear effects - Coherence and dephasing processes

UNIT II **12 hr**

Synthesis of Nanoscale materials and structures

Methods of making 0-D Nanomaterials:

Inert gas condensation, Inert gas expansion, Sonochemical processing, Spray pyrolysis - Sol-gel deposition and molecular self-assembly

Methods of making 1-D and 2-D Nanomaterials:

Foil beating – Electrodeposition – Physical Vapor Deposition (PVD) – Chemical Vapor Deposition (CVD)

Methods of making 3-D Nanomaterials:

Top down processes: milling and mechanical alloying

Methods of nanoprofiling:

Micromachining – Photolithography*

PPH41

Course Code:

UNIT III **12 hr**

Characterization of Nanomaterials

Scanning Electron Microscope – Transmission Electron Microscope – Atomic Force Microscope – Scanning Tunneling Microscope – Near Field and Confocal Scanning Light Microscope – X-ray Diffraction - UV-Vis Spectrophotometer –Laser Raman Spectrometer – X-ray Photoelectron Spectroscopy – Energy dispersive mass analyser

UNIT IV **12 hr**

Properties of Nanomaterials

Mechanical properties of nanostructured materials: nanodispersions, nanocrystalline solids - Thermal properties: melting point, thermal transport - Electrical properties – Magnetic properties – GMR - Optical properties - Surface plasmon resonance - Acoustic Properties – Catalytic properties

UNIT V **12 hr**

Nanotechnology applications

Biosensors: Silicon Nanowire Biosensor, Cantilever Biosensor, Plasmonic Biosensor, Artificial Nose Biosensor – Drug Development and Targeted Drug Delivery: siRNA drug delivery, Stimuli activated drug delivery – Food Packaging and Monitoring –Photovoltaics: Dye sensitized solar cell, Quantum dot sensitized solar cell – Rechargeable Batteries: Impact energy capacity, battery power, charge rate and lifetime –Data storage: MRAM, NRAM, PRAM, Displays: OLED, QDLED, wireless sensing and communication

*** Self Study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for Study:

1. Micheal F. Ashby, Paulo J. Ferreira,Daniel , L. Schodek, (2009) Nanomaterials, Nanotechnologies and Design: An Introduction for engineers and Architects (Unit I, II, III & IV), Elsevier Science
2. Robert Kelsall, Ian hamley, MarkGeoghegan, (2005), Nanoscale Science and Technology (Unit I, II,V), John Wiley & Sons, Ltd.
3. Guozhong Cao, (2004), Nanostructures and Nanomaterials:Synthesis, Properties and Applications (Unit IV), Imperial College Press
4. Matteo Bonazzi, (2013), Nanotechnologies: Principles, Applications, Implications and Hands-on Activities (Unit V), European Commission,

Books for Reference:

1. Masuo Hosokawa, Kiyoshi Nogi, Makio Naito, Toyokazu Yokoyama, (2007), Nanoparticle Technology Handbook, Elsevier Science.
2. Hari Singh Nalwa, (2000), Handbook of Nanostructured materials and nanotechnology Academic Press Vol (1-5)

PPH42

Course Code:

Mapping					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	H	H	S	H
CO 2	H	S	S	H	H
CO 3	H	H	S	H	S
CO 4	S	H	H	S	H
S- Strong	H-High		M-Medium		L - Low

PPH43

MAJOR ELECTIVE PAPER: 2

Course Code:

Programme: 03		**M.Sc Physics**		
Course Code:		**Atmospheric Science**		
Batch 2018-2019	**Semester**	**Hours/Week 5**	**Total Hours 75**	**Credits 5**

Course Objective

To enable the learners to

1. study about atmospheric thermodynamics and radiation
2. impart knowledge on clouds and precipitation and Air pollution.
3. study about meteorological systems and global energy balance

Course Outcome (CO)

K1	**CO1**	Know the composition and structure of atmosphere.
K2	**CO2**	Describe atmospheric thermodynamics and radiations
K3	**CO3**	Able to interpret clouds and precipitation
K4	**CO4**	Deliver the meteorological systems and global energy balance and to calibrate air pollution

Unit I **12hrs**

Atmosphere

Origin and composition of the atmosphere, distribution of pressure and density, ionosphere, atmospheric electric field and magneto sphere, distribution of temperature and winds, measurement of temperature and humidity, measurement of wind and masses, measurement of precipitation, modern metrological instruments.

Unit II **12hrs**

Atmospheric Thermodynamics and Radiations

Gas laws and equation of state for a mixture of ideal gases, work, heat and First Law of thermodynamics, adiabatic processes, moist thermodynamics and latent heats, thermodynamic diagram, saturated adiabatic and pseudoadiabatic processes, stability criteria using parcel method, stability criteria using slice method, entrophy and second law of thermodynamics, Carnot cycle and Clausius Clapeyron equation, Black body radiation, absorption and emission of radiation by molecules, indirect estimate of solar irradiation at the top of the atmosphere, scattering of solar radiation.

Unit III **12hrs**

Clouds and Precipitation

Atmospheric Aerosols, Aerosol size and concentration, sources and sinks of atmospheric aerosol, Nucleation theory of water vapour condensation, cloud condensation nuclei, growth of cloud droplets in warm clouds by condensation, Grouth of cloud droplets by collision and coalescence, mechanism of cloud formation, types of clouds, cloud seeding, role of clouds and precipitation products in charge separation, mechanism of charge separation, circulation and vorticity, Kelvin's circulation theorem.

Course Code:

Unit IV **12hrs**

Meteorological Systems and Global energy balance

Air masses, warm front, cold front, stationary front, occluded fronts, monsoons, differential heating of Land and Sea, compressibility, rotation and moisture effects, tropical and oceanic convergent zones, monsoon disturbances, semi permanent monsoon systems over India, factors responsible for the formation of tropical cyclone, climatology of tropical cyclones, movement of tropical cyclones, life cycle of a tropical cyclones, tropical cyclone structures, thunderstorms, life cycle of thunderstorms, tornadoes, global energy balance requirement for the earth's atmosphere, energy processes in the upper atmosphere, weather forecasting and climate forecasting.

Unit V **12hrs**

Air pollution

Air pollution in perspective - The LOS Angeles Smog-Global and regionalpollutants- The principal atmosphericpollutants, effects of air pollution - healtheffect-effects on plants and animals, effects on materials and services, source of air pollution-identifying air pollution-Natural sources-Domestic sources-Commercial sources-Industrial sources-Agricultural sources-Transformation related sources, control of air pollution-Natural cleaning of the atmosphere-Air quality control, particleemission control, gasemission control, Nitrogenoxideemission control, Ambient air quality control by Dilution, Predictor air pollution concentration-Airpollutionmeteorology.

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for study:

1. A.Chandrasekar, Basics of Atmospheric science, (2010), PHI Learning Private Limited, New Delhi-110001
2. J.GlynnHenry,Gary, W.Heinke, Environment Science and Engineering, (2009), PHI Learning private Limit, New Delhi

Books for reference:

1. J.Wallace, P.Hobbs, (2006), Atmospheric Science-An Introductory Survey, Elsevier, Second Edition.
2. Frederick K.Lutgens, Edward J.Tarbuck, (2010), The atmosphere-An Introduction to Meteorology, PHI Learning Private Limited, New Delhi-01
3. Minali Krishnan. (1995), Air pollution and control, K.V.S.G, Kaushal&Co,

Mapping					
	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**S**	**H**	**H**	**S**	**H**
CO 2	**H**	**S**	**S**	**H**	**H**
CO 3	**H**	**H**	**S**	**H**	**S**
CO 4	**S**	**H**	**H**	**S**	**H**
S- Strong	**H-High**		**M-Medium**		**L – Low**

PPH45

MAJOR ELECTIVE PAPER: 3

Course Code:

Programme: 03		M.Sc Physics		
Course Code:		Biomedical Instrumentation		
Batch 2018-2019	Semester IV	Hours/Week 5	Total Hours 75	Credits 5

Course Objective

To enable the learners to

1. Impart knowledge on various biomedical instruments
2. understand the working of biomedical instruments

Course outcome (CO)

K1	**CO1**	Learn several signals that can be measured from the human body. Specific examples include temperature, electrical, and pressure signals.
K2	**CO2**	Understand theory and design on Measurement of blood flow and pressure.
K3	**CO3**	Understanding the problem and ability to identify the necessity of equipment to a specific problem.
K4	**CO4**	Study the designs of several instruments used to acquire signals from living systems. Integrate information learned about biomedical signals, sensors and instrumentation design.

UNIT I **15 hrs**

Bioelectric potential and transducers

Origin of bioelectric signals – Electrocardiogram – Electroencephalogram – Electromyogram – Physiological transducers – classifications – characteristics – variable resistance, capacitance, inductance transducers – LVDT – Piezoelectric transducers – pressure transducers – LVDT and strain gauge transducers – electrical resistance thermometer – Photoelectric transducers – Photovoltaic and Photoemissive cells – **Silicon diode detectors and diode arrays***

UNIT II **15 hrs**

Pulmonary function Analyzers

Ventilation, distribution and diffusion –Respiratory volumes and capacities– Basic Spirometer and Ultrasonic Spirometer.

Blood Gas Analyzers

Acid – Base balance, Blood pH measurements – electrodes for blood pH measurements – Effect of blood on electrodes – Buffer solutions. Measurement of blood pCO_2 - blood pO_2 measurements – A complete blood gas analyzer.

Oximeters

Principle of oximetry – invitro-oximetry and invivo-oximetry. Ear oximeter and pulse oximeter.

UNIT III **15 hrs**

Blood Cell Counters and Audiometer

Types of blood cells - Methods of cell counting- Automatic optical method - Electrical conductivity method - Coulter counter – Mechanism of hearing – Measurement of Sound – Basic audiometer – Hearing Aids – conventional and digital hearing aids.

PPH46

Course Code:

Bio-medical Recorders

Electrocardiograph (ECG) – block diagram description of an ECG – ECG leads (basic concepts) – Microprocessor based ECG machines - Electroencephalograph (EEG) – block diagram description of an EEG – Computerized analysis of EEG.

Telemedicine

Telemedicine applications – Telemedicine concepts – essential parameters for telemedicine – block diagram explanation of a typical telemedicine system – **Concepts of Telemedicine technology***

UNIT IV **15 hrs**

Modern Imaging Systems

X-Rays: Nature of X-rays, properties and units of X-rays- X-ray machine – Visualization of X-rays: - X-ray Image Intensifier System – Basic Principle of X-ray Computed Tomography.

Magnetic Resonance Imaging

Principles of NMR imaging systems – Fourier transformation of the FID - Basic NMR components – block diagram explanation – biological effects of NMR imaging - Advantages of NMR imaging System.

Ultrasonic Imaging Systems

Principle of Ultrasonic waves – Generation and detection of Ultrasound – Medical ultrasound – ultrasonic imaging instrumentation.

UNIT V **15 hrs**

Electrical safety of medical instruments

Introduction – radiation safety instrumentation - physiological effects due to 50 Hz current passage – micro shock – macro shock – electrical accidents in hospitals – devices to protect against electrical hazards – hospital architecture.

*** Self study**

Teaching Methods: Power Point Presentation / Seminar / . / Discussion / Assignment

Books for study:

1. R.S Kandpur, Hand book of Biomedical instrumentation , (2014), Tata McGraw Hill Publishing Co.
2. Dr.M.Arumugam, (2010), Biomedical Instrumentation, Anuradha Agencies Publishers, Kumbhakonam.

Book for reference:

1. Leslie Crombwell, Fred.J.Weibell & Trich.A.Pfeiffer, (2011), Biomedical Instrumentation and Measurements, Prentice Hall of India,.
2. H.S.Kalsi Electronic Instrumentation, , (2013)Tata Mc GrawHill Co.

Mapping					
	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	S	H	H	S	H
CO 2	H	S	H	H	H
CO 3	H	S	H	H	S
CO 4	S	H	S	H	H
S- Strong	**H-High**		**M-Medium**		**L - Low**

PPH47

MAJOR ELECTIVE PAPER: 4

Course Code:

Programme: 03		**M.Sc. Physics**		
Course Code:		**Problems in Physics**		
Batch **2018-2019**	**Semester**	**Hours/Week** **5**	**Total Hours** **75**	**Credits** **5**

Course Objective

1. To impart knowledge and skills to solve problem through the concept behind Physics
2. To apply multitude of creative thinking techniques towards the realistic problem
3. To define a plane for implementing lessons from the course once back on the job.

.

Course outcome (CO)

K1	**CO1**	Understand the problem in the related nuclear, atomic, condensed matter, electromagnetics and electronics field
K2	**CO2**	Segregate the Physics involved in each section of the problem
K3	**CO3**	Recollect the related formulae and apply them in the respective areas necessary
K4	**CO4**	Solve problems in nuclear, atomic, condensed matter, electromagnetics and electronics

UNIT I

Nuclear Physics **12 hrs**

Density of nucleus- radius of nucleus-calculation of mass and mass number of ion-determination of mass of hydrogen-binding energy of isobars-existence of stable isobars-energy release when two nuclei fuse together-calculation of nuclear force. [Problem no. 1-17, Page No. 986-991, Objective type questions 1 to 50]

UNIT II **12 hrs**

Atomic Physics

Orbital magnetic dipole moment: Bohr Magneton – Larmor precision- spectroscopic terms and their notations – Stern-Gerlach experiment –Spin-orbit interaction – transition rules (selection rules) – Intensity rules – Quantitative rules I and II – Hydrogen fine structure – Formulation of Pauli's principle – L-S coupling and j-j copling – selection rules for multi-electron atoms in LS coupling- selection rules for j-j coupling. [Problem no. 1-22, Page No. 760-764, 797-804, Objective type questions 1 to 50]

UNIT III **12 hrs**

Condensed Matter Physics

Crystal structure - semiconductor - Fermi level - Intrinsic and extrinsic carrier concentration - Mean free path - Magnetism - Debye Temperature - Superconductors - Vortex state - Meissner effect [Problem no. 1-25, Page No. 907-920, Objective type questions 1 to 50]

Course Code:

UNIT IV **12 hrs**

Electromagnetics

Charge density – total charge of the system – distribution of electric charge – Yukawa Potential – Spherically Symmetric charge distribution – Scalar and Vector Functions of an electric field – Electric field inside a uniformly polarized sphere and inside a dielectric – Electrostatic energy of an electron - Coplanar electric dipoles – Array of charges –Repulsion between a point charge and a spherical conductor – Negative charge inside an hydrogen atom – Potential energy of a nucleus. [Problem 1 to 16, Page no 285 to 293, Objective type questions 1 to 50].

UNIT V **12 hrs**

Electronics

Semiconductor device Physics including diodes, junctions, transistors, field effect devices, homo- and hetero-junction devices, device structure, device characteristics, Opto-electronic devices including solar cells, photo-detectors, LEDs – Operational amplifiers and their applications- Impedance Matching, amplification (Op-amp based, instrumentation amp, feedback) [Problem no. 1-8, 11-13, 36-39, 47,48 ,57 Page No. 570-573,637-664, Objective type questions 1 to 50]

* **Self study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for study:

1. Dr.SurekhaTomar, CSIR-UGC NET/JRF/SET Physical Science, Upkar Prakahan, Agra

Books for Reference:

1. Jain K.C. Arora, (2012), Numerical Problems in Physics, S.Chand & Co
2. Bukhovtsev.B.Krivchenkov, (2012), Problems in Elementary Physics, CBS Publishers and distributors Pvt Ltd
3. R. Murugeshan and Er. Kiruthiga Sivaprasath, (2014), Modern Physics, S.Chand & Co

Mapping					
	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**S**	**H**	**H**	**S**	**H**
CO 2	**H**	**S**	**H**	**H**	**H**
CO 3	**H**	**S**	**H**	**H**	**S**
CO 4	**S**	**H**	**S**	**H**	**H**
S- Strong	**H-High**		**M-Medium**		**L - Low**

NON-MAJOR ELECTIVE PAPERS

(2 papers are to be chosen from the following 4 papers)

1. **Electronics and Microprocessors**
2. **Applied Physics**
3. **Energy Physics**
4. **Industrial Physics**

PPH50

Non - Major Elective Paper: 1

Course Code:

Programme code : 03		**M.Sc Physics**		
Course Code:		**Electronics and Microprocessors**		
Batch **2018-2019**	**Semester**	**Hours/Week** **5**	**Total Hours** **75**	**Credits** **5**

Course Objective

To study about the

1. Power electronics, operational amplifiers and its applications and non linear IC circuits
2. Architecture, instruction set, interfacing and programming of 8085 microprocessors.

Course Outcome (CO)

K1	**CO1**	Will get knowledge on crystalline and amorphous nature of semiconductors
K2	**CO2**	Will be able to understand the method of preparation of thin films
K3	**CO3**	Will apply knowledge on Photolithography for manufacturing of LED
K4	**CO4**	Will be able analyze the problems in LED production and its performance

UNIT I **15 hrs**

Power Electronics

Power electronics – Triac – triac construction- triac operation – triac characteristics – Applications of triac - Diac – Applications of diac – Unijunction transistor (UJT) – UJI – Equivalent circuit – Characteristics of UJT - Applications of UJT.

UNIT II **15 hrs**

Amplifiers and Nonlinear integrated circuits

Operational Amplifiers - Inverting amplifiers, non-inverting amplifiers-differential amplifier – integrator and differentiator* – logarithmic amplifiers and multipliers – filters - voltage to current converters – sample and hold circuits- high input impedance amplifiers – instrumentation amplifiers- sensing amplifiers and comparators – zero crossing detectors – window detector – Time marker.

UNIT III **15 hrs**

Microprocessors Architecture

Introduction –Intel 8085-pin diagram- Architecture-Instruction cycle –Timing diagram for OP code fetch cycle –Memory read –Memory write –I/O read-I/O write –Instruction set – Addressing mode.

UNIT IV **15 hrs**

Peripheral devices and their interfacing

Introduction –Addressing space partitioning – Memory and I/O interfacing –Programmable peripheral interface Intel 8255 –Programmable DMA controller Intel 8257- Programmable communication interface Intel 8251-Programmable counter/Time interval Intel 8253

Course Code:

UNIT V

Microprocessor based data acquisition system and applications

Introduction –Analog to digital converter (ADC)-Digital to analog (DAC)-Microprocessor – LED Interfacing –Stepper Motor Interfacing –Traffic control simulation –Music tone generator –Temperature controller.

*** Self study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for study:

1. Millman and Hilkais, (1983) Integrated Electronics, Tata McGraw Hill Publications
2. B.Ram (2011) Fundamentals of Microprocessors & Microcontrollers, Dhanpat Rai Publications

Books for Reference:

1. V.K.Mehta (2014) Principles of Electronics, S.Chand & Company
2. P.Mathur,C.Kulshreshta and R.Chada (2005) Electronic devices Applications and , Integrated circuits, Umesh Publications
3. D Roy Choudhary, Shail B.Jain (2014) Linear integrated circuits, New age Int Pub.
4. V.Vijayendaran, S.Vishwanathan (2011) Introduction to Integrated electronics, digital and analog , Printers and Publishers Pvt.Ltd
5. Albert Paul, Malvino (1997) Digital Principles and Applications, McGraw Hill Publications

Mapping					
	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	**S**	**H**	**H**	**H**	**S**
CO 2	**S**	**S**	**S**	**S**	**H**
CO 3	**H**	**M**	**S**	**S**	**S**
CO 4	**H**	**S**	**S**	**H**	**S**
CO 5	**S**	**S**	**H**	**S**	**H**
S- Strong	**H-High**		**M-Medium**		**L - Low**

PPH52

Non - Major Elective Paper: 2

Course Code:

Programme code : 03		**M.Sc Physics**		
Course Code:		**Applied Physics**		
Batch 2018-2019	**Semester**	**Hours/Week 5**	**Total Hours 75**	**Credits 5**

Course Objective

1. To know about crystalline and amorphous semiconductors.
2. To know thin film deposition techniques.
3. To know about LED & production of laser diodes.

Course Outcome (CO)

K1	**CO1**	Get knowledge on crystalline and amorphous nature of semiconductors
K2	**CO2**	Understand the method of preparation of thin films
K3	**CO3**	Apply knowledge on Photolithography for manufacturing of LED
K4	**CO4**	Analyze the problems in LED production and its performance

UNIT I **12 hrs**

Crystalline and amorphous semiconductors–general introduction–band structure of crystalline and amorphous semiconductors (qualitative). Carrier transport phenomena–mobility lifetime. Optical properties of solids-Optical constants-fundamental absorption in semiconductors-direct and indirect transmission, Photoconductivity, Radiative transmissions-**Photoluminescence***- Methods of excitation- efficiency.

UNIT II **12 hrs**

Device Physics: p-n junction-depletion region and depletion capacitance (abrupt junction)-current-voltage characterization-heterojunction-depletion layer photodiodes-avalanche photodiodes. Solar cell basic characteristics-spectral response recombination - current and series resistance, semiconductor lasers-transition process-population inversion-gain junction lasers-threshold current density.

UNIT III **12 hrs**

Important elemental and compound semiconductors-Ge, Si, Se, Te, II-VI,III-V, IV-VI and amorphous Si. single crystal growth techniques-float zone-Czochralski-hydrothermal growth - growth of GaAs-production of Si and GaAs**. Wafers-growth of quartz.***

UNIT IV **12 hrs**

Thin film deposition techniques-thermal and electron gun evaporation - DC and RF sputtering. Epitaxial film deposition techniques-CVD, VPE, LPE and MBE – general ideas.

UNIT V **12 hrs**

Production of difused p-n junction-transistor, planar epitaxial technology-photo-lithography, production of integrated circuits-production of LED-production of laser diodes, both homo and hetero junctions.

*** Self study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

PPH53

Course Code:

Books for study:

1. S. M. Sze (2006) Physics of Semiconductor devices, Willey online Library
2. L.Maissel and R. Glang (1970) Handbook of Thin Film Technolog, Mcgraw-Hill

Books for Reference:

1. R.A.Smith (1959) Semiconductors,Cambridge University Press
2. B.R.Pamplin (1975) Crystal Growth Pergamon Press
3. W.Bardsley, D.T.O.Hurle and J.B.Mulin, (1981)Crystal Growth: A Tutorial approach Journal of Applied Crystallography
4. R.J.Elliot and A.P.Gibson (1974) An Introduction to Solid State Physics and its applications, Macmillan Publications
5. A.Yariv (1991) Optical Electronics, Saunders College Publishing

Mapping					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	H	H	H	S
CO 2	S	S	S	S	H
CO 3	H	H	S	S	S
CO 4	H	S	S	H	S
S- Strong	H-High		M-Medium	L - Low	

PPH54

Non - Major Elective Paper: 3

Course Code:

Programme code : 03		M.Sc Physics		
Course Code:		Energy Physics		
Batch 2018-2019	Semester	Hours/Week 4	Total Hours 60	Credits 5

Course Objective

1. To know about solar radiation & solar pond
2. To know about photovoltaic energy conversion
3. Students to know hydrogen energy, wind energy & OTEC
4. Students to understand the importance of energy auditing and carbon credits.

Course Outcome (CO)

K1	CO1	Understand the nature of solar radiations and the conversation of solar radiation into thermal energy by means of solar energy collectors
K2	CO2	Understand the basics of solar energy into electrical energy conversion, material selection, solar cells and applications
K3	CO3	Know the principles of wind energy into electrical energy conversion, turbines, basic components of conversion system and its application
K4	CO4	Know the principles of principles of energy conservation and energy audit, global climate change, emissions from combustion of natural gas and carbon credits & its implantation projects.

UNIT I **15 hrs**

Solar thermal energy

Introduction on solar radiation - solar constant - solar radiation at the earth surface - physical principles of the conversion of solar radiation into heat solar energy collectors - flat plate collectors - advantages of flat plate collectors - concentrating collector parabolic through reflectors and mirror - strip reflector - advantages and disadvantages of concentrating collectors over flat plate type collectors - solar energy storage - solar pond - principle of operation and description of non-convective solar pond - **applications of solar ponds***.

UNIT II **15 hrs**

Solar photovoltaic energy

Solar photovoltaic: Introduction - Fundamentals of photovoltaic conversion - semiconductor materials - photon energy - electron - hole concentration and Fermi level –A p-n junction – light absorption in a semi conductor- solar cell materials - efficiency of solar cells - silicon solar cell - polycrystalline & amorphous silion cells - **photovoltaic applications***.

UNIT III **15 hrs**

Wind and Ocean thermal energy

Introduction - Basic principles of wind energy conversion – nature of wind - the power and the wind - forces on the blades and thrust on turbines - wind energy conversions - site selection conservations - basic components of the wind energy conversion system - classification of WEC systems - advantages and disadvantages of WECs - energy storage - applications of wind energy.

PPH55

Course Code:

Ocean thermal energy

Introduction: Ocean thermal energy conversion (OTEC) – methods of ocean thermal electric power generation - open cycle OTEC system - heat exchangers - bio-fouling – site selection – energy utilization - hybrid Cycle.

UNIT IV **15 hrs**

Hydrogen energy and Fuel cells

Hydrogen energy

Introduction - hydrogen production - electrolysis or the electrolytic production of hydrogen - solar energy methods - bio-photolysis and photo-electrolysis - hydrogen storage – hydrogen transformation - utilization of hydrogen gas - electric power generation - hydrogen in fuel cells - **Hydrogen as an alternative fuel for motor vehicles ***- safety and management.

Fuel Cells:

Introduction – Principle of operation of a fuel cells - classification of fuel cell - hydrogen fuel cells - Advantages and disadvantages of fuel cells - applications of fuel cells.

Unit V **15 hrs**

Energy Auditing and Carbon Credit

An Economic concept of Energy – Principles of Energy conservation and Energy Audit - types of energy Audits – **Global Climate change - Greenhouse effect*** – Emissions from Combustion of Natural gas.

Emission trading: The definition and concept – carbon credits – carbon currency – carbon credits under Kyoto Protocol.

Trading of Carbon Credits and India's perspectives – Implementing of CDM projects in India – Potential CDM projects in India.

***Self-study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for study:

1. H.P. Garg and J. Prakash (2002) Solar energy fundamentals and applications, McGraw Hill,
2. Stephen J.Fonash (2010) Solar Cell Device Physics, Elsevier Publishers
3. G.D.Rai (2014) Non Conventional Energy Sources,Fifth Edition, Khanna Publishers,
4. A.N. Sarkar (2010) Emissions trading and carbon management, Pentagon Press

Books for Reference:

1. Fahrebruch & Bube (1983) Fundamentals of solar cells, photovoltaic solar energy Academic Press
2. Winter & Nitch (1988) Hydrogen as an energy carrier, Springer, New Delhi
3. Albert Thumann (1984) Fundamentals of energy engineering , The Fairmont Press

Mapping					
	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	S	H	H	S	H
CO 2	H	S	S	H	S
CO 3	S	H	S	S	H
CO 4	S	H	S	H	H
S- Strong		**H-High**	**M-Medium**		**L - Low**

PPH56

Non - Major Elective Paper: 4

Course Code:

Programme code : 03		**M.Sc Physics**		
Course Code:		**Industrial Physics**		
Batch **2018-2019**	**Semester**	**Hours/Week** **4**	**Total Hours** **60**	**Credits** **5**

Course Objective

To enable the learners to

1. Understand the working of SCR, UJT, Jones circuit and Triac circuits.
2. Understand the construction and working of flip-flops, registers converter and microprocessors.
3. Understand the working of the production of vacuum and construction of pumps and gauges
4. Understand the working of heating system, photodiode, gauges etc.,

Course Outcome (CO)

K1	**CO1**	Get knowledge on different types of transistors, regulators and microprocessors
K2	**CO2**	Understand the working mechanism of SCR, Flip-flops, Thermocouple and vacuum gauges
K3	**CO3**	Apply knowledge on vacuum techniques, applications of SCR, Switching circuits and Industrial heating systems
K4	**CO4**	Able analyze the problems involved in biasing of transistors, industrial transducers and production of vacuum

UNIT I **15 hrs**

Time-delay action – RC time constant. Direct coupling of transistor- Darlington circuit – Differential Amplifier, Uni junction transistor – Silicon Controlled Rectifiers (SCR) - SCR in simple AC circuits – phase control of the SCR – firing by UJT- phase control by pedestal and ramp – turn off of SCR. Jones circuit - Triac circuits – **Zero voltage switching circuit*.**

UNIT II **15 hrs**

Regulators of voltage and motor speed – voltage compensator – DC voltage regulated DC regulated Power supplies. Inverters – multivibrator inverter – two SCR inverter. Closer loop systems – Servomechanisms – basic part of a serve – complete serve diagram – loop gain – PID controllers.

UNIT III **15 hrs**

Switching and counting circuits – flip-flops – shift register – serial to parallel converter. MOS gates – complementary MOS – digital to analog converter – sample and hold information conversion – parallel to serial converter – multiplexer – addressing – BCD and octal binary codes – numeric displays - microprocessor and its operation (elementary ideas).

UNIT IV **15 hrs**

Industrial heating systems – electron beam heating – microwave heating – induction heating. Measurement of light , PMT – photodiode – IR detectors – Temperature – Thermocouple amplifiers - optical pyrometer – strain – strain gauges – electrochemical transducers – pH.

PPH57

Course Code:

UNIT V **15 hrs**

Production of vacuum – rotary pumps – diffusion pumps – ion getter pumps – design of high vacuum units – Ultra high vacuum units. Measurement of pressure – Pirani gauge – Penning gauge – Hot cathode ionization gauges – **UHV gauges***.

*** Self study**

Teaching Methods: Power Point Presentation / Seminar / Discussion / Assignment

Books for study:

1. G.M. Chute and R.D. Chute (1995) Electronics in Industry, McGraw Hill International
2. R.W.Henry (1978) Electronic Systems and Instrumentation, Wiley & Sons Publishing
3. Malvino (1992) Digital Computer Electronics, McGraw Hill Publishing

Book for Reference:

1. R.W.Perbwitt , S.W.Farads (1962) Instrumentation: Experimentation and Application , Wiley Publishing
2. S.Dushman, J.M.Lafferty (1962) Scientific foundation of Vacuum Technology, John Wiley
3. Lloyd.P.Hunter (1956) Hand book of Semiconductor Electronics, McGraw Hill,

Mapping					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	S	H	H	S	H
CO 2	H	S	S	H	S
CO 3	S	H	S	S	H
CO 4	S	H	S	H	H
S- Strong	H-High		M-Medium		L - Low