COURSE PATTERN - M.Sc. PHYSICS

Sem.	Code	COURSE	Hours	Credit
I	16PPH1101	Core 1:Classical Mechanics	6	6
	16PPH1102	Core 2:Mathematical Physics	6	6
	16PPH1103*	Core 3:Analog and Digital Electronics	6	6
	16PPH1104	Core 4:Physics Practical-I	8	4
	16PPH1401	IDC-1(WS) Physics for Competitive Examinations	4	4
		Total for Semester 1	**30**	**26**
II	16PPH2105	Core 5:Quantum Mechanics	6	6
	16PPH2106	Core 6:Electrodynamics and Plasma physics	6	6
	16PPH2107	Core 7:Microprocessor and Microcontroller**	6	6
	16PPH2108	Core 8:Physics Practical-II	8	4
	16PPH2109	*Self paced learning**	--	2
	16PSK2401	IDC-2 Soft Skills: Common Syllabus	4	4
		Total for Semester 2	**30**	**28**
III	16PPH3110	Core 9:Statistical Mechanics and Thermodynamics	5	5
	16PPS3101	Core 10:Methods of Spectroscopy and Lasers	5	5
	16PPH3111	Core 11:Physics Practical-III	8	4
	16PPH3201A OR 16PPH3201B	Core Elective -1A : Numerical and Statistical Methods OR Core Elective-1B: Medical Physics	4	4
	16PPH3202A OR 16PPH3202B	Core Elective-2A:Non-Destructive Testing OR Core Elective-2B: Fiber Optic Communication	4	4
	16PPH3402	IDC-3(BS):Modern Photography	4	4
		Total for Semester 3	**30**	**26**
IV	16PPH4112	Core 12:Nuclear, Particle and Astrophysics	6	6
	16PPH4113	Core 13:Condensed Matter Physics	6	6
	16PPH4114	Core 14:Physics Practical IV	8	4
	16PPH4203A OR 16PPH4203B	Core Elective 3A:Nano Science and Nano Technology** OR Core Elective 3B:Digital Photography**	4	4
	16PPH4115	Comprehensive Examination		2
	16PPH4116	Project Dissertation & *Viva Voce*	6	3
		Total for Semester 4	30	25
I-IV	16PCW4501	SHEPHERD		5
		Total for all Semesters	**120**	**110**

* Intellectual resources will be shared among Chemistry, Electronics and Physics Departments.

WS – IDC within School

BS – IDC between Schools

Self Paced courses:

1. Thin film physics and Crystal Growth(16PPH2109A)
2. Ultrasonic Fundamentals ,Sources ,Measurement and Applications (16PPH2109B)
3. Laser Physics(16PPH2109C)

** OOC techniques will be applied.

Note: 1. Comprehensive Examination - an online objective type Test based on the question bank given to the

Sem. I
16PPH1101

Hours/Week: 6
Credits : 6

CLASSICAL MECHANICS

Assurance of Learning

The students will learn the following after going through this course

- The fundamental principles of classical mechanics.
- The applications of classical mechanics.
- The concepts of Relativistic mechanics
- Apply the concepts of Relativistic mechanics

Unit-I: FUNDAMENTAL PRINCIPLES AND LAGRANGIAN FORMULATION (15 Hours)

Mechanics of a particle and system of particles - conservation Hlaws - constraints - generalized coordinates - D' Alembert's principle and Lagrange's equation- Problem: Free particle in a system - Atwood's machine – Time dependent constraint - bead sliding on a rotating wire - Hamilton's principle - Lagrange's equation of motion from Hamilton's principle - conservation theorems and symmetry properties.

Unit-II: TWO-BODY CENTRAL FORCE PROBLEMS (15 Hours)

Equations of motion and first integrals - The equivalent one - dimensional problem and classification of orbits - The Kepler problem - Inverse square law of force, the Laplace Runge - Lenz Vector - Scattering in a central force field - Scattering in laboratory and centre of mass frames.

Unit-III: HAMILTON'S FORMULATION (15 Hours)

Cyclic coordinates - Hamilton's canonical equations of motion - Hamilton's equations from variational principle - Principle of least action - Application - canonical transformations- Infinitesimal constant transformations- Lagrange and Poisson brackets - Hamilton - Jacobi method - Action angle variables - Kepler problem in action angle variables.

Unit-IV: RIGID BODY DYNAMICS AND OSCILLATORY MOTION (15 Hours)

Euler angles - Moments and Products of inertia - Euler's equations - symmetrical top - applications - theory of small oscillations and normal modes - frequencies of free vibration and normal coordinates - Linear triatomic molecule.

Unit -V: RELATIVISTIC MECHANICS (15 Hours)

Algebra of tensors - quotient law - fundamental tensor - Cartesian tensors - four vectors in special theory of relativity - Lorentz transformations in real four dimensional spaces, Covariant four dimensional formulations - force and energy equations in relativistic mechanics - Lagrangian and Hamiltonian formulation of relativistic mechanics.

Book for Study

1. Herbert Goldstein: Classical Mechanics, 2nd Edition, New Delhi: Narosa Publishing House, 2001.

UNIT	BOOK	SECTIONS
I	1	1.1 -1.4, 1.6, 2.1, 2.3, 2.4, 2.6
II	1	3.2, 3.3, 3.7, 3.9, 3.10
III	1	8.2, 9.1, 8.5, 9.2, 9.4, 9.5, 10.1, 10.6, 10.7
IV	1	4.4, 5.3, 5.5, 5.7, 6.1- 6.4
V	1	5.2, 7.3, 7.5, 7.6, 7.8

Books for Reference

1. Rana, N.C. and Joag, P. S.: Classical Mechanics, (New Delhi, Tata McGraw Hill,1998) (Units I, II & III).
2. Matrices & Tensors in physics by AW Joshi - Weiley Eastern.

Sem. I **Hours/Week: 6**
16PPH1102 **Credits: 6**

MATHEMATICAL PHYSICS

Assurance of Learning

The students will learn the following after going through this course

- Various mathematical concepts and techniques in vector space, groups, functions and transforms.
- Apply these techniques to solve Physics problems.

Unit - I : VECTOR ANALYSIS IN CURVED COORDINATES ,LINEAR VECTOR SPACES AND MATRIX THEORY (15 Hrs)

Orthogonal coordinates in R^3 – Differential vector operators –Special coordinate systems- circular cylindrical coordinates- spherical polar coordinates - Vector spaces: Linear dependence and independence of vectors – inner products - Schmitt's orthogonalization method - Schwartz in equality –Matrix theory: Determination of Eigen values and Eigen functions – eigen vectors and their properties - diagonalisation of matrices - Matrices in Classical and Quantum Mechanics: Rotation matrix, Pauli Spin matrices, Dirac matrices - Matrix representation of an operator.

Unit II : GROUP THEORY (15 Hrs)

Definition and nomenclature - Rearrangement theorem - cyclic groups - subgroups - conjugate elements and class structure - identification of symmetry element and operations - molecular point groups – matrix representation of symmetry operations - The Great Orthogonality Theorem

- (qualitative treatment) - character of representation - character table generating symmetry operators – construction of character tables – irreducible representation for C2v and C3v groups

- symmetry species specifications.

Unit III : SPECIAL FUNCTIONS (15 Hrs)

Gamma and Beta functions - properties and their basic relations. DE and series solution of Legendre and Hermite - their polynomial, Rodrique's formula, generating function - recurrent relation - orthogonality relations.

Unit IV : TRANSFORMS (15 Hrs)

Fourier series: Dirichlet's condition - determination of coefficient – function having arbitrary period -Fourier series for square wave and half wave. Fourier Transform: FT of a time dependent function - some important theorems: Parseval's, linearity, derivatives, shifting of origin and convolution use of FT in solving partial differential equation for heat conduction. Laplace transform: Theorems - inverse transform - solution to ordinary differential equations - solving equations for LCR circuit.

Unit V: COMPLEX ANALYSIS (15 Hrs)

Cauchy - Riemann conditions - Cauchy's I integral theorem - applications to multiply connected region - Cauchy's II integral theorem - derivatives of analytic Complex function - Singular points and their classification – Laurent series - Cauchy's residue theorem - calculation of residue at a point evaluation of definite integrals: (i) around the unit circle, (ii)around a

Semicircular contour, and (iii) integral of the form $\int F(x)dx$.

Books for study

1. Arfken&Weber mathematical methods for physicists 6th edition.Academic press(Elsevier),2009.
2. Joshi AW - Matrices and Tensors in Physics - New Age Int. Ltd. Pub., New Delhi, 3/e, 2006.
3. Tinkham M - Group Theory and Quantum Mechanics - McGraw Hill - New Delhi. 1964.
4. Aruldhas G - Molecular Structure and Spectroscopy - Prentice Hall of India, New Delhi, 2/e, 2009.
5. Bell W & Van Dale - Special Functions for Engineers and Scientists - Nostrand Company Ltd., 1969.
6. Mathemati cal Met hods for Engineers and Physi ci st s - A. K Mukhopadhyay, Wheeler Publications, New Delhi. 1998.

UNIT	BOOK	SECTIONS
I	1 2	2.1-2.5 1.3-1.7,5.3-5.8,9.1-9.3,14.1-14.4
II	3	Ch. 1, Ch2: 1- 4
II	4	Ch 5: 5.1 – 5.13
III	5	2.1 – 2.4, 3.1 – 3.5, 3.7, 5.1 – 5.6
IV	6	Ch. 7, 13: 7.1 – 7.10, 13.1 – 13.14
V	6	Ch. 14.2 – 14.5 (relevant portions)

Books for Reference

1. Mathematical Physics, H.K.Dass, S.Chand, New Delhi, 2006.
2. Mathematical Physics, Satya Prakash, Sultan Chand, New Delhi, 2008.

Sem. I **Hours/Week: 6**

16PPH1103 **Credits: 6**

ANALOG AND DIGITAL ELECTRONICS

Assurance of Learning

The students will learn the following after going through this course

- Various techniques and concepts in Electronics.
- Apply these techniques in practical circuits.
- Develop the skill in handling instruments.

Unit I : ELECTRONIC DEVICES (15 Hrs)

SCR- Characteristics - parameters - control circuits using SCR, TRIAC and DIAC, UJT- characteristics -parameters - Relaxation oscillator - UJT control of SCR, LED, LCD, voltage variable capacitors diodes.

Unit II : OP-AMP APPLICATIONS AND VOLTAGE REGULATION (15 Hrs)

Basic operational amplifier circuit, IC 741, Direct coupled voltage follower, non-inverting and inverting circuits, Difference amplifier, Summing amplifier, Schmitt trigger. Sine wave generators - Op-amp phase shift oscillator and Op-amp Wein's bridge oscillator. Voltage regulators - Transistor Series regulator with error op-amp amplifier, The 723 IC Regulator, Three terminal Regulators.

Unit III : DAC, ADC AND TIMER CIRCUITS (15Hrs)

DAC and ADC - Introduction, Digital to analog converters- Weighted Resistor DAC - R-2R ladder DAC -Specifications for D/A converters. Sample and hold circuit, Analog to Digital converters.

Timing circuits - Introduction, Applications of logic gates in timing circuits, Op-amp and its applications in timing circuits, 74121 Monostable multivibrator IC, 555 Timer - Monostable and Astable multivibrators.

Unit IV: COMBINATIONAL LOGIC DESIGN (15 Hrs)

Simplification of logical functions using K map, Applications of K-map- Arithmetic circuits BCD-to-7-segment Decoder and Gray code converters, Quine - McCluskey minimization technique, Combinational logic design using MSI circuits - Multiplexers – Demultiplexers / Decoders, BCD Arithmetic, ALU, Digital comparators (2-bit), Parity generators / checkers, Priority encoders.

Unit V: SEQ UENTIAL LOGIC DESIGN, SEMICONDUCTOR MEMORIES AND DIGITAL EQUIPMENTS (15 Hrs)

Register s, Application s of shift register s, Asynchronous counter s, UP/DOWN counters, Modulus of the counter, Series asynchronous counters ICs (Only Group A), Synchronous counter design. Memory devices - Introduction, ROM, Memory expansion, Applications of ROMs, RAM, IC 7489, Charge Coupled Devices. Digital building blocks, Digital voltmeters, Frequency counter, period counter, Digital clock, Digital audio.

Books for Study

1. David A. Bell, Electronic devices and circuits, 3rd edition, Prentice Hall of India, New Delhi, 1999.

2. R.P. Jain, Modern Digital Electronics, 3rd edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2003.

3. Virendrakumar, Digital Technology, New Age International Pvt. Ltd., New Delhi, 1995.

Unit	Book	Sections
I	1	18.1 – 18.4, 18.6 – 18.10, 19.8, 19.9, 20.3.
II	1	13.1, 13.2, 13.4-13.7, 13.9, 15.1, 15.4, 16.4, 16.7, 16.8.
III	2	9.1 - 9.3, 9.5.1, 9.6, 10.1, 10.2, 10.4, 10.5.
IV	2	5.3 - 5.7, 5.8.1, 5.8.2, (Ex. 5.19,& 5.20), 5.11, 6.1 - 6.3, 6.5- 6.8, 6.10, 6.11.
V	2 3	8.1 - 8.4, 8.5.1, 8.5.2, 14.1, 14.2, 14.5, 14.6, 14.9, 14.18, Chapter 16.

Books for Reference

1. Roy Choudhury, D and Shall Jain, Linear Integrated Circuits, Wiley Eastern Ltd., New Delhi, 2005.

2. Thomas L. Floyd and R.P. Jain, Digital Fundamentals, Eighth Edition, Pearson Education Pvt. Ltd., 2008.

Semester: I **Hours: 8**
16PPH 1104 **Credit: 4**

Core: 4 PHYSICS PRACTICALS -I

Assurance of Learning

The students will learn the following after going through this course

- Various techniques and concepts in Electronics
- Various techniques and concepts in General Physics experiments
- Develop the skill in handling instruments.

1	Absorption Spectrum of Iodine
2	χ - Quincke's method
3	e/m Magnetron and ϕ - Work function
4	Dielectric Constant Study – Solid, Liquid, Wave meter and Lecher wire
5	Hall effect in semiconductor
6	Elastic Constants – Elliptic fringes
7	Laser – I :Diameter of wire, diffraction
8	Planck's constant & Photo sensitive devices
9	Ultrasonic interferometer
10	BJT Amplifier design
11	UJT – Characteristics and Applications
12	Regulated PS – Zener and IC
13	K- map simplification – implementation basic and universal gates by SOP & POS
14	Encoder and Decoder
15	ALU and Scalar
16	555 – Astable and its applications
17	Op-amp: Basic circuit design
18	Op-amp: I to V, V to I and Square wave
19	Wien's Bridge Oscillator : Op-amp
20	Computer: Numerical Problem - I
21	Thin film experiments – Thin film research lab

Semester II **Hours : 4**
16PPH1401 **Credit : 4**

IDC-1(WS) : PHYSICS FOR COMPETITIVE EXAMS

Assurance of Learning
The students will learn the following after going through this course

- Basic principles of physics
- Competitive examination skills
- Sharpen the thought process toward the objective type questions

Unit – I: GENERAL MECHANICS AND PROPERTIES OF MATTER

Physical quantities, SI system of units, Dimensions, Scalars and Vectors (Concepts), Newton's Equations of Motion, impulse, Principle of conservation of Linear momentum, Projectiles, Kepler's Laws, Newton's Law of Gravitation, acceleration due to gravity, Escape velocity, Angular momentum, banking of roads, simple harmonic motion, Viscosity, Surface Tension

Unit – II: HEAT AND THERMODYNAMICS

Different scales of temperatures, thermal expansions, Calorimetry – specific heat, latent heat, triple point, transmission of heat, heat conductivity, Black bodies, Stefan Boltzmann Law, Wien's Displacement Law, Gas Equation, Boyle's Law, Charle's Law, Law of equipartition of energy

Unit – III: LIGHT AND SOUND

Reflection, Refraction and total internal reflection of light and their applications, propagation of light, Refractive index, Prism, Lenses, mirrors, Aberration in Lenses, Optical instruments – microscopes, telescopes, binoculars, Defects of Human Eye

Wave motion, longitudinal and Transverse waves, velocity of sound- Newton's formula, Laplace correction, effects of pressure - beats , laws of vibrating strings, open and closed organ pipes, Resonance

Unit – IV: ELECTRICITY AND MAGNETISM

Electric charge, field, potential, Resistances, Capacitance , cells and their combinations, Kirchoff's laws, Ohm's law, Faraday's laws, Lenz's law, Galvanometer, Voltmeter, Ammeter, Current Electricity.

Earth's Magnetism, bar magnet, Magnetic moment, Magnetic field, magnetic substances, torque of a bar magnet placed in a magnetid field, electromagnet.

Unit – V: MODERN PHYSICS AND ELECTRONICS

Bohr's theory, H spectrum, Nuclear Physics, Binding Energy, X – rays, Alpha, Beta and Gamma rays, Einstein's photo electric effect and mass-energy relations

Semi-conductors, Diodes, Transistors, Rectifiers, Amplifiers, Oscillators, Boolean Algebra, Logic gates, Electronics in Communication.

BOOK FOR STUDY :
Physics for Competitive Exams - Department of Physics , St. Joseph's College, Tiruchirappalli-2
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Semester-II **Hours/ Week: 6**
16PPH2105 **Credit : 5**

QUANTUM MECHANICS

Assurance of Learning

The students will learn the following after going through this course

- Basic idea of Dirac formalism in Quantum Mechanics.
- Apply the same formalism to study the angular momentum concept, scattering of fundamental particles and necessary relativistic modification in particle behavior.
- The concept on relativistic wave equations.

Unit-I: DIRAC'SFORMALISM (15Hrs)

Fundamental postulates of QM- Bra and Ket notations-Linear operators-Orthogonalityofeigenfunctions-observables-thecompletenesscondition-imultaneouseigenketsofcommutingobservables-eigen value problem-uncertainty product- harmonic oscillator wave functions- the number operator-the unitary transformation-Schrodinger and Heisenberg Pictures.

Unit-II:ANGULARMOMENTUM (15Hrs)

The angular momentum operator- eigen values and eigen functions of Lz- The commutation relations- angular momentum and rotations-ladder operators- the constants C_+ and C- - angular momentum matrices corresponding to j=½ Pauli spin matrices -Pauli wave function and Pauli equation-addition of angular momenta-Clebsh-Gordan Coefficients for $j_1=j_2=½$ -concept of isospin.

Unit-III:APPROXIMATIONMETHODS (15Hrs)

JWKB solutions - the connection formulae - application of JWKB solutions to eigen value problems. Time independent perturbation theory -non- degenerate (first and second order) states - degenerate states - fine structure of the hydrogen atom. Variational method - Applied to hydrogen atom. Time dependent perturbation theory: time development of states , transition probability-adiabatic and sudden approximation.

Unit-IV:THEORYOFSCATTERING (15Hrs)

Definition and interpretation of scattering cross section - quantum theory of scattering - The Green's function- The Born approximation - applied to shielded Coulomb potential. Method of Partial Waves : expansion formula for a plane wave, scattering by a hard sphere, a square well & the Ramsauer effect, neutron by proton-Coulomb scattering.

Unit-V:RELATIVISTICWAVEEQUATIONS (15Hrs)

The Klein-Gordan equation - the Dirac Equation - Dirac's α and β matrices-probability and current density- plane wave solution-the electron in an electro magnetic field - the spin orbit interaction - central potential-energy levels of the hydrogen -the hole theory and positrons.

Books for Study

1. Ajoy Ghatak and S.Lokanathan, Quantum Mechanics :Theory and Applications,MacmillanIndiaLtd.,NewDelhi,2007.

Unit	Chapters	Sections
I	11,12	11.1–11.6,11.8–11.10,12.1–12.4,12.7–12.9
II	9,13,18	9.1-9.7,13.1-13.4,13.6,13.8,13.9,18.1–18.6
III	17,19,21,25	17.1-17.4,19.1-19.3,19.5,21.1-21.3,25.1,25.2,25.4-25.7
IV	24	24.1–24.7
V	28	28.1-28.10,28.12-28.14

Books for Reference

1. Richard L Liboff, Introduction to Quantum Mechanics, Pearson Education Ltd., 4/e, 2006.
2. AFJ Levi, Applications of Quantum Mechanics, Cambridge University Press, Delhi, 2009.
3. Thankappan, V.K. - Quantum Mechanics, Wiley Eastern Ltd., New Delhi, 2nd Edn, 1995.
4. G. Aruldhas, Quantum Mechanics, Prentice Hall of India, New Delhi, 2003.

Sem. I **Hours/Week: 6**
16PPH2106 **Credits: 6**

ELECTRODYNAMICS AND PLASMA PHYSICS

Assurance of Learning

The students will learn the following after going through this course

- The basics of electrostatics and magnetostatics.
- The wave propagation in different media and flow of power.
- The reflection of EM waves in conductor and dielectric and the analogue of EM waves.
- The modes of propagation of guided waves and propagation through wave guides.
- The concepts of plasma physics.

Unit I: ELECTROSTATICS AND MAGNETOSTATICS

Gauss's law & its proof– the potential function – Divergence theorem - Laplace & Poisson's equations – condition at a boundary between dielectrics — electrostatic uniqueness theorem – Dirac Delta representation for a point charge and an infinitesimal dipole - magnetic field strength and magnetomotive force – Ampere's law – Biot Savart's law – Ampere's law in differential vector form – magnetic scalar and vector potential – electromagnetic induction.

Unit II: APPLIED ELECTROMAGNETIC WAVES

Equation of continuity for time varying fields – Inconsistency of Ampere's law – Maxwell's equations – derivations – electromagnetic waves in free space – uniform plane wave propagation – wave equations for conducting medium – Maxwell's equation in phasor form – wave propagation in lossless, conducting and dielectric media – depth of penetration.

Unit III: ELECTROMAGNETIC WAVES IN BOUNDED MEDIA & POWER FLOW

Poynting's theorem – statement and proof – Interpretation of Poynting's vector – Power flow for a plane wave – power flow in a concentric cable and conductor having resistance – Instantaneous , average and complex Poynting vector – power loss in a plane conductor and a resonator – Boundary conditions – proof - reflection of plane waves by a perfect conductor for normal and oblique incidence – reflection of plane waves by a perfect dielectric for normal and oblique incidence – Brewster's angle.

Unit – IV: GUIDED WAVES AND WAVE GUIDES

Waves between parallel planes – Transverse electric waves – Transverse magnetic waves – characteristics of TE and TM waves – Transverse electromagnetic waves – Attenuation in parallel and plane guides – Attenuation for TE waves, TM waves and TEM waves – Rectangular guides – Transverse magnetic waves and Transverse electric waves in rectangular guides – Field configurations for dominant TE and TM modes – Impossibility of TEM wave in wave guides – Transmission line analogy for wave guides – Q factor of wave guides.

Unit V: PLASMA PHYSICS

Introduction – kinetic theory of plasma – principle of detailed equilibrium – hydrodynamic equation – momentum transfer equation – equations of continuity - Boltzmann equation - production of plasma - plasma oscillation – electrical conductivity of plasma – thermal pinch effect – dielectric properties – magnetic properties – Propagation of Electromagnetic waves in plasma - observation of plasma radiation using diagnostic technique.

Books for study:

1. Edward C. Jordan & Keith G. Balmain, Electromagnetic waves and Radiating Systems – Second edition ,Prentice Hall of India, New Delhi, 2009.
2. B.S. Saxena, P.N. Saxena, & R.C. Gupta, Fundamentals of Soild state Physics, Pragati Prakasan Publications, 2001.

Unit	Book	Sections
I	1	2.03, 2.04, 2.07, 2.08, 2.11, 2.13, 2.15, 2.16 3.04, 3.05,3.10,3.11, 3.12, 18.13
II	1	4.01,-4.03, 5.01 – 5.06
III	1	4.04, 5.09-5.15, 6.01 -6.04
IV	1	7.01 -7.05, 7.07, 8.01 -8.04, 8.09,8.10
V	2	19.1, 19.8, 19.9,19.10, 19.11, 19.13, 19.14,19.17, 19.20

Books for Reference:

1. David I. Griffiths, Introduction to Electrodynamics, Prentice Hall of India , New Delhi , 2003.
2. B.B. Laud, Electromagnetics, Second edition, Wiley Eastern Limited, 1990.

Semester-II **Hours/ Week: 6**
16PPH2107 **Credit : 6**

MICROPROCESSOR AND MICROCONTROLLER

Assurance of Learning

The students will learn the following after going through this course

- The Microprocessor and Microcontroller architecture.
- The Instruction set of processor and controller.
- The interfacing applications.

Unit-I MICROPROCESSOR ARCHITECTURE, INSTRUCTION SET AND INTERFACING (15 Hrs)

Intel 8085 Microprocessor Architecture, Pin configuration, Instruction cycle, Timing diagram, Instruction and data formats, Addressing modes, Status flags, Intel 8085 instructions. Address Space partitioning, Memory and I/O Interfacing, Data transfer schemes, Interrupts of Intel 8085. Generation of control signals for memory and I/O devices

Unit-II MICROPROCESSOR PROGRAMING (15 Hrs)

Assembly language, Stacks, Subroutines, MACRO, Delay Subroutine. Examples of Assembly language Programming- addition-subtraction –complement- shift –mask-look-up table- To find the largest and smallest number in a data array- sorting-sum of a series- Multiplication- Division- multi-byte addition and subtraction.

Unit – III Microcontroller – 8051 (15 Hrs)

Microprocessor and Microcontroller – Overview of 8051 Family – Pin Description of 8051 – Registers - Program Counter, ROM space, RAM space, Stack, PSW, SFR – Addressing Modes – Jump Call Instructions – Time delay generations and Calculations - Arithmetic and Logic Instructions – Bit Instructions – Assembly Language Programming – Data Types and Directives.

Unit – IV Microcontroller SFRs and Programming (15 Hrs)

Counter/Timer – Counter Programming – Basics of Serial Communication – RS232 Connections and ICs Max 232 – 8051 Serial Communication Registers - Serial Communication Programming – Interrupts – Interrupts Registers – Internal and External Interrupt Programming.

Unit-V MICROPROCESSOR AND MICROCONTROLLER APPLICATIONS (15 Hrs)

Microprocessor Interfacing and Applications:

Programmable peripheral interface Intel 8255, Interfacing 7 segment LED display, ADC 0809, Measurement of frequency, Microprocessor based traffic control, To generate square wave or pulse using Microprocessor.

Microcontroller Interfacing and Applications:

Interfacing – LCD, Stepper Motor, Keyboard and DAC.

Books for Study:

1. B. Ram, Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai Publications (P) Ltd., New Delhi (2005).
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi – The 8051 Microcontroller and Embedded Systems, Pearson Education, Delhi, Seventh Indian Reprint 2004.

Unit	Book	Sections
I	1	3.1, 3.2, 3.3, 4.1, 4.2, 4.3 4.4, 4.6, 7.2, 7.3, 7.4, 7.5, 7.6.1
II	1	5.2, 5.5, 5.6, 5.14, 9.2, 6.1-6.32, 6.34, 6.35
III	2	1.1,1.2,4.1,2.1,2.4,2.7,2.6,5.1,5.2,3.1,3.2,3.3,6.1,6.2, 6.3, 7.1, 7.2, 7.3, 8.1, 8.2, 2.2, 2.3, 2.5
IV	2	Chapter 9, 10, 11
V	1	7.7.1-7.7.4, 8.8, 9.3, 9.5.1, 9.8, 9.9
	2	Chapter 12, 13

Books For Reference

1. A.P.Godse and D.A.Godse, Microprocessors and its applications (First edition), Technical Publications, Pune , 2006.
2. A.Nagoor Kani,Microprocessors & Microcontrollers,1st edition, RBA Publications,Chennai, 2006.

Semester: II **Hours: 8**
16PPH 2108 **Credit: 4**

Core: 8 PHYSICS PRACTICALS – II

Assurance of Learning

The students will learn the following after going through this course

- Various techniques and concepts in Electronics
- Understand various techniques and concepts in General Physics experiments
- Develop the skill in handling instruments.

1	Spectrum Photo – Cu / Fe Arc Spectrum
2	χ - Guoy's method
3	Michelson Interferometer
4	Biprism – Optic bench
5	Energy Gap study of a semiconductor
6	Elastic Constants – Hyperbolic fringes
7	Laser – II : Wave length of He-Ne, thickness
8	e – Millikan's oil drop method
9	Ultrasonic diffraction
10	FET Amplifier design
11	SCR – Characteristics and Applications
12	Transmission Line Characteristics
13	Parity Checker / Generator & Comparator by gates
14	BCD Adder and Subtractor
15	Shift Registers using Flip-Flop & ICs
16	555 – Monostable and its applications
17	Op-amp: Parameters calculation
18	Op-amp : Low &High and band pass Filters
19	Phase Shift Oscillator : Op-amp
20	Computer: Numerical Problem – II
21	Ultrasonic Experiments – Ultrasonic research lab

Semester – II
16 PPH 2301A **Credit : 2**

SELF PACED COURSE: PHYSICS OF THIN FILM AND CRYSTAL GROWTH

Assurance of Learning

The students will learn the following after going through this course

- Preparative techniques of thin films and crystal.
- Theoretical concepts of thin films and crystal
- Characterizing techniques.

UNIT-I Preparative techniques of thin film - physical methods-Vacuum evaporation, sputtering chemical methods-chemical vapour deposition,Electro and electroless coating hybrid methods-dip coating,spin coating

UNIT-II Thickness measurement and Nucleation growth- gravimetric -microbalance– electrical –resistance ,capacitance method–optical –Fieazu fringes method- Four stages of film growth - Incorporation of defects during growth.

UNIT-III Theory of nucleation in crystal growth
Theories of nucleation - classical theory of nucleation - Gibbs Thomson equation for vapour - Modified Thomson equation for melt - Gibbs-Thomson equation for solution - Energy of formation of a nucleus – Spherical nucleus - Cylindrical nucleus - Heterogeneous nucleation

UNIT-IV Preparative techniques of Crystal
Crystal growth from melt: Czocharlski technique-Bridgmann-stockbarger technique - Crystal growth from Solution: Low temperature solution growth - Slow cooling technique - Slow evaporation technique - High temperature solution growth - Gel growth.

UNIT-V Characterization Techniques-Structural –XRD, Micro hardness electrical-DC and AC conduction-Four Probe technique ,impedance analysis, LCR bridge measurement, optical-FTIR –functional analysis-UV-Visible -transmittance ,reflectance, and Absorbance

Books for study
Study material prepared by the department.

Semester II **Credit-2**
16PPH2301B

SELF PACED COURSE: ULTRASONICS – FUNDAMENTALS, SOURCES, MEASUREMENT AND APPLICATIONS

Assurance of Learning

The students will learn the following after going through this course

- Fundamentals of Ultrasound and Transducers.
- Theoretical concepts of Ultrasonics
- Applications of Ultrasonics and NDT.

UNIT I: FUNDAMENTALS OF ULTRASOUND

Introduction – Classification of sound waves – Ultrasonic waves – Different modes of Ultrasonic waves –Characteristics Properties of Ultrasonic waves – Velocity – Specific acoustic impedance – Acoustic intensity and pressure – Behaviour of Ultrasonic waves – Reflection and transmission at normal incidence –Diffraction.

UNIT II: ULTRASONIC TRANSDUCERS

Piezoelectric Effect – Piezoelectric crystals — Advantages and limitations of quartz – Transducer Materials – Piezoelectric ceramic materials – Polymer materials – Materials for transmission and reception – Thickness selection of a Piezoelectric Element.

UNIT III: MEASUREMENT TECHNIQUES OF ULTRASOUND

Detection of Ultrasonic Waves –Optical Method – Electrical Method –Pulse echo overlap method –Resonance ultrasound spectroscopy – Laser Interferometry.

UNIT IV: APPLICATIONS OF ULTRASOUND – GENERAL AND ADVANCED

Classification of Ultrasonic Applications –Welding – Cleaning – Flow meters – Food industry – Concrete testing — Echo sounder – Length meters -Applications – Level meters – Thickness measurements – Ultrasonic microscopy

UNIT V: ULTRASONIC NON-DESTRUCTIVE TESTING

Classification of Non-Destructive Testing – Ultrasonic Testing – Classification of Ultrasonic Testing – Pulse echo –Resonance – Surface wave – Different Types of Techniques in Pulse Echo Method – Flaw Detectors – Functions of a flaw detector – Different types of scans – Applications of Flaw Detectors

Book for Study:

Baldev Raj, V Rajendran and P Palanichamy, Science and Technology of Ultrasonics, 2nd edition, Narosa Publishing House, New Delhi, 2009.

Semester-III **Hours/Week: 5**
16PPH3109 **Credit : 5**

STATISTICAL MECHANICS AND THERMODYNAMICS

Assurance of Learning

The students will learn the following after going through this course

- The fundamental concepts of thermodynamics to understand Statistical Mechanics.
- The principles of classical statistical mechanic and its application to compute the various parameters of molecules.
- The need for quantum Statistical Mechanics and its various applications.
- The concept of Boltzmann transport equation and its applications and the principle of fluctuations in thermodynamic quantities.
- The phase transition of a system and its models.

Unit I: Foundation and fundamentals of Statistical Mechanics (15 Hrs)

Entropy and second law of the thermodynamics- Entropy and disorder- thermodynamic potentials and the reciprocity relation- thermodynamic equilibrium-Nernst's heat theorem- chemical potential-phase space-volume in phase space-concept of ensembles-micro canonical- canonical- grand canonical- Liouvilles theorem- micro and macro states- Gibb's paradox.

Unit II : Classical statistical mechanics (15 Hrs)

Classical Maxwell-Boltzmann distribution law- evaluation of constants- distribution of velocities- principle of equipartition of energy-connection between the partition function and thermodynamic quantities- mean values obtained from distribution law- Boltzmann's entropy relation.

Unit III: Quantum Statistical mechanics (15Hrs)

Statistical weight-Bose-Einstein Statistics-Fermi-Dirac Statistics- Maxwell-Boltzmann- black body radiation and Planck's radiation law-energy and pressure of Bose-Einstein and Fermi-Dirac-gas degeneracy- Bose-Einstein condensation-electron gas

Unit IV: Transport properties and fluctuations in thermodynamic quantities (15 Hrs)

Boltzmann transport equations-Boltzmann transport equations for electrons and Lorentz solution-chambers equation-thermal conductivity of metals- fluctuations in energy, pressure –probability of one dimensional random walk- Brownian movement- Fokker Planck equation- Nyquist's theorem.

Unit V: Phase transitions and its models (15 Hrs)

Phase transitions-first and second kind – YANG and LEE theory - critical exponent-phase transition of second kind- Ising model - Bragg Williams approximation- one dimensional Ising model. Super fluidity: Tisza's two fluid model and second sound – Landu's theory.

Book for Study: 1. Gupta S.L & Kumar V., Statistical Mechanics, Pragati Prakashan, Meerut, 2006.

Unit	Book	Sections
I	1	**A.2 –A.7, 1.1, 1.1-1, 1.3, 1.3-1 ,1.3-2, 1.3-3, 1.7, 2.1, 3.0.3**
II	1	**2.7, 2.9, 2.10, 2.12, 2.14, 2.15-2.16**
III	1	**5.9, 6.2, 6.3, 6.4, 6.10, 8.0-8.2, 9.0, 9.3**
IV	1	**10.1-10.3, 10.5, 12.1, 12.2, 12.5 – 12.7, 12.10**
V	1	**13.1-13.7, 8.4.0, 8.4.1, 8.4.2**

Semester-III **Hours/Week: 5**
16PPS3101 **Credit : 5**

METHODS OF SPECTROSCOPY AND LASERS

Assurance of Learning

The students will learn the following after going through this course

- The various spectroscopic techniques
- The applications of spectroscopy
- The concept of laser devices and its applications

Unit I: Rotational and Vibrational spectroscopy

Basic aspects of spectroscopy-characterization of EM radiation, quantization of energy-Microwave spectroscopy-rotation of molecules and selection rules, diatomic molecules; Rigid and Non-rigid rotator-rotational constant-centrifugal distortion constant-techniques and instrumentation (FT-IR).

Vibration Spectroscopy - diatomic molecules; Harmonic and anharmonic oscillators, Zero point energy - force constant- fundamental absorption and overtones (hot bands, Fermi resonance)-polyatomic molecules-Techniques and instrumentation

Unit II: Raman and NMR Spectroscopy

Raman spectroscopy: Raman Rayleigh scattering- Quantum and Classical theory of Raman effect- Pure rotational Raman spectra - Stokes and anti-Stokes lines - Vibration Raman spectra - mutual exclusion principle- Polarized and depolarized Raman lines- Techniques and instrumentation.

NMR Spectroscopy- Hydrogen nuclei- chemical shift-spin-spin splitting- coupling constant-Instrumentation- Interaction between spin and magnetic field- Gyromagnetic ratio- FT-NMR.

Unit III: ESR and Mossbauer Spectroscopy

ESR- Principle - position of ESR absorptions - g value - hyperfine splitting - zero field splitting - ESR spectrum of free radicals and complex

Mossbauer Spectroscopy - Principle - Doppler shift - recoil energy - isomer shift - quadrupole splitting - hyperfine splitting - Applications.

Unit IV: Electronic Spectroscopy

Electronic spectra of diatomic molecules- Born-Oppenheimer approximation - vibrational coarse structure - Frank-Condon Principle - dissociation energy and dissociation product-rotational fine structure of electronic vibration - vibration transtitions - Fortrat diagram-electronic angular momentum in diatomic molecules-spectrum of Molecular hydrogen-Molecular photo electron spectroscopy - UV photo electron spectroscopy - X-ray photo electron spectroscopy.

Unit V: Laser devices and their applications

Principle- pumping - He-Ne laser- Carbon-di-oxide laser - semi conductor laser-Holography-recording and reconstruction - applications - laser induced fusion - fusion process - stimulated raman scattering - lasers in isotope separation - lasers in industry- Lidar - laser tracking - lasers in medicine.

Books for Study:

1. Colin N. Banwell and E. M. McCash, Fundamentals of Molecular Spectroscopy, TMH Edition, 4th Edition (1994).
2. Ghatak & Thyagarajan, Lasers Theory and applications, Macmillan India Ltd., (1997).

Unit	Book	Sections
I	1	1.1, 1.2, 1.3,2.1 ,2.2, 2.3.1,2.3.2,2.3.3,2.3.4,2.3.5,2.4,2.5,3.1.1,3.1.2, 3.1.3,3.2,3.3,3.5.1,3.5.2,3.6.1,3.6.3,3.8
II	1	4.1,4.1.1,4.1.2,4.2.1,4.2.2,4.2.3,4.3.1,4.3.2,4.3.3,4.3.4,4.3.5,4.4.1,4.6, 7.1.1,7.1.2,7.1.3,7.1.4,7.1.5,7.1.6,7.2.1,7.2.2,7.2.3,7.2.4,7.2.5,7.3.1,7.4, 7.4.1,7.4.2
III	1	7.5.1,7.5.2,7.5.3,7.5.4,7.5.5,9.1,9.2.1,9.2.2,9.2.3
IV	1	6.1.1,6.1.2,6.1.3,6.1.4,6.1.5,6.1.6,6.1.7,6.2.3,6.2.4,6.4,6.5.1,6.5.2
V	2	9.4,9.6,9.8,10.3,11.1,11.2,11.3,11.4,13.3,13.9,14.1-14.5

Books for Reference:

1. Straughan B.P and Walker.S, Spectroscopy Vol. 1,2,3, Chapman and hall, London (1996).
2. Gurdeep R. Chatwal and Sham K. Anand, Spectroscopy, Himalaya Publishing House (2009).

Semester: III **Hours: 8**
16PPH 3111 **Credit: 4**

Core: 11 PHYSICS PRACTICALS – III

Assurance of Learning

The students will learn the following after going through this course

- Various techniques and concepts in Electronics
- Understand various techniques and concepts in General Physics experiments
- Develop the skill in handling instruments.

1	e/m Zeeman effect
2	Microwave – Klystron
3	Laser III:Refractive index,Brewster's ang
4	Multiplexer and Demultiplexer
5	Digital to Analog Converters
6	ROM – Construction and Study
7	Design of Asynchronous Counter
8	Power Amplifier : Transistor & IC
9	DIAC ,TRIAC – Characteristics & Application
10	Mod & Demod: PAM,PPM,PWM
11	Geiger Muller Counter
12	μP – Programming- I :
13	μP – Programming –II:
14	μP – Interfacing – I : Traffic controller
15	μP – Interfacing – II: Stepper Motor
16	μP – Interfacing –III: Voltage / Temperature measurement
17	Multiplexed display
18	MC – Programming & Interfacing – I
19	MC – Programming & Interfacing – II
20	Computer: Numerical Problem – III
21	MC- Programming with C Simulator - I
22	Crystal Growth Experiments – Crystatl Growth research lab

Sem. III **Hours/Week: 4**
16PPH3201A **Credits: 4**

Core Elective-1A:
NUMERICAL AND STATISTICAL METHODS

Assurance of Learning

The students will learn the following after going through this course

- The different numerical methods and their applications.
- The different computational techniques for physics applications.
- The statistical methods.

Unit-I:NUMERICAL SOLUTION OF LINEAR AND NONLINEAR EQUATIONS (10 Hrs)

Newton - Raphson method: iterative rule - termination criteria - rate of convergence - Simultaneous linear algebraic equations: - Augmented matrix - Gauss elimination - Inverse of a matrix by Gauss-Elimination method.

Unit II : INTERPOLATION AND CURVE FITTING (10 Hrs)

Interpolation: Newton's interpolation - Linear interpolation - Higher-order polynomials - Divided differences — Gregory-Newton forward and backward interpolation formulae - error in interpolation — Lagrange interpolation.

Unit III: NUMERICAL DIFFERENTIATION, INTEGRATION AND ODE (10 Hrs)

Numerical integration: trapezoidal, Simpson's 1/3 rules - Truncation error - composite trapezoidal, and Simpson's 1/3 rules. ODE: Euler and fourth-order Runge-Kutta methods for first order ODE.

Unit - IV: LEAST SQUARES METHOD (10 Hrs)

Derivate of tabulated function - summation formula - Difference equation with constant coefficient - Curve fitting: Method of least-squares- normal equations - straight-line, exponential fits and power-law fits.

Unit - V: STATISTICAL METHODS (10 Hrs)

Discrete Probability distribution - Continuous distribution - Expectations - Moments and Standard Deviations - Binomial Distribution – Poisson Distribution - Gaussian Distribution

Books for Study:

1. M.K. Venkataraman, Numerical Methods in Science & Engineering, National Pub. Co. Madras, 1993. (for units I, II, and III,IV).
2..Dr.H.K.Dass Mathematical Physics S.Chand & company Ltd 2001 (unit V)

Books for Reference:

1. Pipes, L.A. & Harvil, L.R., Applied Mathematics for Engineers and Physicists, McGraw Hill Company, New Delhi.

Semester –III **Hours/Week: 4**
16 PPH3402 **Credit:4**

INTER DEPARTMENTAL COURSE: MEDICAL PHYSICS

Assurance of Learning

The students will learn the following after going through this course

- The concept of forces, pressure and the importance of temperature in human body.
- The physics principles involved in respiration and cardiovascular system.
- How the electric signals generate in human body and the working of EMG and ECG.
- The application of sound and light in medicine and medical imaging.
- The use of X-rays and radioactivity for diagnosis and treatment.

Unit I MECHANICS OF HUMAN BODY (12 Hrs)

Static , Dynamic and Frictional forces in the Body – Composition, properties and functions of Bone – Heat and Temperature – Temperature scales – Clinical thermometer – thermography – Heat therapy – Cryogenics in medicine – Heat losses from body – Pressure in the Body – Pressure in skull, Eye and Urinary Bladder.

Unit II PHYSICS OF RESPIRATORY AND CARDIOVASCULAR SYSTEM (12 Hrs)

Body as a machine – Airways – Blood and Lungs interactions – Measurement of Lung volume – Structure and Physics of Alveoli – Breathing mechanism – Airway resistance – Components and functions of cardiovascular systems – work done by heart – components and flow of Blood – Laminar and Turbulent flow – blood Pressure – direct and indirect method of measuring – Heart sounds.

Unit III ELECTRICITY IN THE BODY (12 Hrs)

Nervous system and Neuron – Electrical potentials of Nerves – Electric signals from Muscles , Eye and Heart – Block diagram and working to record EMG – Normal ECG wave form – Electrodes for ECG – Amplifier and Recording device – Block diagram and working to record ECG – Patient monitoring – Pace maker.

Unit IV SOUND AND LIGHT IN MEDICINE (12 Hrs)

General properties of sound – Stethoscope – Generation ,detection and characteristics of Ultrasound – Ultrasound imaging technique – A scan and B scan methods of ultrasound imaging – properties of light – Applications of visible UV,IR light , and Lasers in medicine – Microscope – Eye as an optical system- Elements of the Eye – Ophthalmology instruments .

Unit V DIAGNOSTIC X- RAYS AND NUCLEAR MEDICINE (12 Hrs)

Production and properties of X- rays – Basic Diagnostic X-ray Machine – X-ray image - Live X-ray image –X-ray computed Tomography – Characteristics of Radio activity- Radioisotopes and Radio nuclides – Radioactivity sources for nuclear medicine – Basic instrumentation and clinical applications- Principles of Radiation Theraphy- Nuclear medicine imaging devices – Radiation sources

Books for Study:

Medical Physics by Department of Physics, St.Joseph's College., Trichy-2.

Books for Reference:

1. John R. Cameron and James G. Skofronick, John Wiley &Sons –Medical Physics, Wiley – Interscience Publications ,1978.
2. R.S.Khandpur – Handbook of Biomedical Instrumentation, Tata McGraw Hill Publication Co.,Delhi,1987.

Semester – III **Hours/Week : 4**
16PPH3202A **Credit : 4**

Core Elective: NON –DESTRUCTIVE TESTING

Assurance of Learning

The students will learn the following after going through this course

- A skill in Non-Destructive Testing
- The principles of NDT methods
- The various applications.

UNIT I: VISUAL EXAMINATION & LIQUID PENETRANT TESTING
Basic principles- The eye- Unaided visual inspection- Optical aids used for visual inspection- Application – Liquid penetrant testing - Physical principles procedure – Penetrant testing materials - Testing methods –Applications and limitations.

UNIT II: MAGNETIC PARTICLE TESTING and EDDY CURRENT TESTING
Principle of MPT – Magnetizing techniques- Procedure- Equipment-Limitations- Eddy Current Testing principles- Instrumentation Techniques- Applications - Limitations

UNIT III: RADIOGRAPHY
Basic principle – X ray source-production of gamma ray sources-Properties of X rays and gamma rays- Attenuation in specimen effect of radiation on film – radiographic imaging –Inspection techniques – Applications - Limitations – Safety in industrial radiography- Neutron radiography.

UNIT IV: ULTRASONIC TESTING
Basic properties of sound beam- Ultrasonic transducers- Inspection methods- Techniques for normal beam inspection - Techniques for angle beam inspection – Flaw characterization techniques , detection equipment- Modes of display- Immersion testing- Applications – Advantages-Limitations.

UNIT V: ADVANCED TESTING TECHNIQUES
Early Observation of Corrosion - corrosion mapping-High Temperature Hydrogen Attack (HTHA)- Detection, Assessment, Evaluation - imaging techniques using Phased-Array and Time-of-Flight Diffraction (TOFD) electromagnetic techniques such as Remote Field Eddy Current (RFEC) for ferrous tube.

Book for study:
Dr.BaldevRaj, T.Jayakumar and M.Thavasimuthu, Practical Non- Destructive testing, Narosa Publications , 2009 .

Sections :

Unit I Chapter 2, sec 2 to 2.4 , Chapter3- sections 3.1 to 3.6.
Unit II Chapter 4, Sections 4.1 & 4.6. Chapter 5, Sections 5.1 to 5.7.
Unit III Chapter 6, Sections 6.1 to 6.14
Unit IV Chapter 7, Sections 7.1 to 7.8.
Unit V Study Material

Book for reference :

1. Nondestructive testing by Hull & John
2. Study Material prepared by the Department

Sem.III **Hours/week: 4**
16PPH3202B **Credits: 4**

Core Elective:
FIBER OPTIC COMMUNICATION

UNIT - 1: INTRODUCTION TO OPTICAL FIBERS

Evolution of fiber optic system- Elements of an Optical Fiber Transmission link- Fiber Types- Rays and Modes – Step Indexed Fiber Structure – Graded Index Fiber Structure – Graded Index Numerical Aperture – Fiber losses.

UNIT - 2: FIBER OPTICAL SOURCES AND COUPLERS

LED- LED materials – Fiber LED coupling – LASER – Spatial emission pattern of LASER – Modulation response of LASER – Single frequency LASER – Light emitting transistor. Optical Couplers: Types of optical couplers – Star couplers – T couplers – Source to fiber coupling efficiency – Opto-couplers and applications.

UNIT - 3: ANALOG AND DIGITAL TRANSMISSION SYSTEM

Overview of Analog Links – Multichannel Transmission Techniques – Multichannel Amplitude Modulation – Multichannel Frequency Modulation – Digital Transmission - Line Coding – NRZ codes = RZ Codes – Block Codes.

UNIT – 4: COHERENT OPTICAL FIBER COMMUNICATION SYSTEM

Fundamental Concepts – Homodyne Detection – Heterodyne Detection – Modulation Techniques – Direct detection OOK – OOK Homodyne Detection – PSK Homodyne Detection – Heterodyne Detection Schemes – Polarization Control Requirements.

UNIT – 5: NETWORK SYSTEMS AND TECHNIQUES

Wavelength Division Multiplexing – Local Area Networks – Optical Fiber Bus – Ring Topology – Star Architectures – Advanced Multiplexing Strategies - Optical TDM, Sub Carrier Multiplexing, WDM Network Architectures.

Book for Study:

1. Optical Fiber Communication – Gerd Keiser – McGraw-Hill – 2nd Edition
2. Optical Communication System – John Gowar – Prentice Hall of India – 2nd Edition
3. Optical fiber and fiber optic communication system – Subir kumar sarkar- S.Chand – 4th Edition (2010).

Unit	Book	Sections
I	1&3	1.2, 1.3, 2.3.1, 2.3.2, 2.3.3, 2.6 & Chapter 7 respectively.
II	3	Chapter 9 & 12.
III	1	9.1,9.3, 9.3.1, 9.3.2, 8.2, 8.2.1-8.2.3
IV	1	10.1,10.3.1-10.3.4,10.4
V	1	11.1, 11.2.1-11.2.3

Reference Book:

1. Govind P. Agarwal - Fiber Optic Communication System John Wiley & Sons (2002)

Semester-III **Hours/Week: 4**
16PPH3403 **Credit : 4**

IDC – 3(BS): MODERN PHOTOGRAPHY

Assurance of Learning

The students will learn the following after going through this course

- Techniques of exposure, developing and printing.
- Operations of digital and video cameras.
- Photoshop.
- Edit the digital images and to mix video and audio.

Unit-I: CAMERA, LENSES, DEVELOPING AND PRINTING (10 Hrs)

SLR Camera – Mechanical and Auto – Interchangeable lenses – Telephoto, Wide angle, Zoom and macro lenses – Developing of the film – Tank Development – Printing – Enlarger.

Unit-II: COLOUR AND DIGITAL PHOTOGRAPHY (10 Hrs)

Colour Photography – Light and colour – Filters for colour – The colour quality – Processing of colour films – Digital photography – Digital still camera and their parts – Types of digital camera.

Unit-III: DIGITAL PHOTOGRPAHY – IMAGE, STORING AND EXPOSURE TECHNIQUES (10 Hrs)

The CCD chips – storing images – The view finder – Optical and LCD display – Optical / Digital zooms – Composing the picture – focus – Depth of field – exposure – white balance.

Unit-IV: BASIC DIGITAL TECHNIQUES – PHOTOSHOP (10 Hrs)

Introduction to Photoshop – starting to use Editing Software – saving the photos – Cropping - Straightening – Resizing – Brightening and Darkening Photos – Removing Red eye.

Unit-V: VIDEO PHOTOGRAPHY (10 Hrs)

Video camera – Principle of camera tube – Types of camera tubes – Block diagram of a video camera and their parts – Handling operations and precautions for the use of a video camera – Video and Audio mixing using software – PC digital video and its applications.

Books For Study:

1. O.P. Sharma – 'Practical Photography', Hind Pocket books(P) Ltd, 1997
2. Alex May – 'Digital Photography', A Dorling Knidersley book, London, 2002
3. Doug Harman – The Digital Photography, Hand Book, Quercus Publishing Ltd., USA – 2010.

Sem. IV **Hours/Week: 6**
16PPH4112 **Credits: 6**

NUCLEAR, PARTICLE AND ASTROPHYSICS

Assurance of Learning

The students will learn the following after going through this course

- The basic structure and properties of the nucleus.
- The causes and mechanism of natural radioactivity.
- The different type of nuclear reactions and to apply this knowledge for producing fission and fusion energy.
- The properties of various fundamental particles, their decay and the interactions.
- The aspects and importance of Astrophysics and Radio astronomy.

Unit I: BASIC PROPERTIES OF NUCLEUS (15 Hrs)

Nuclear mass and binding energy - atomic masses - systematics of nuclear binding energy - nuclear size - charge radius - potential radius - spin and parity - statistics of nucleus - magnetic dipole moment - electric moments - electric quadrupole moments - isospin - nuclear forces - ground state of the deuteron - wave equation for the deuteron and solution - excited state of deuteron - low energy proton neutron scattering - spin dependence of n-p interaction.

Unit II: NUCLEAR DECAY AND RADIOACTIVITY (15 Hrs)

Theory of alpha disintegration - hindrance and formation factors – fine structure of alpha decay - energetics of beta decay - neutrino hypothesis - Fermi theory of beta decay - selection rules - Sargent diagram - orbital electron capture - parity non conservation - double beta decay - gamma ray spectra and nuclear energy level - radio active transition in nuclei - nuclear isomerism-internal conversion - resonance fluorescence - angular correlation.

Unit III: NUCLEAR REACTIONS (15 Hrs)

Types of nuclear reactions - conservation laws - reaction energetics – Q value - threshold energy - nuclear reaction cross section - level width - compound nuclear theory - Briet Wigner dispersion formula and interpretation - direct reaction - striping and pick up reactions -nuclear fission -energy released in fission - nuclear chain reaction - four factor formula - nuclear reactor - nuclear fusion - Stellar energy.

Unit IV: PARTICLE PHYSICS (15 Hrs)

Production of new particles in high energy reaction - classification of elementary particle - fundamental interaction - quantum numbers - anti particles - resonances - law in production and decay process - symmetry and conservation laws -special symmetric groups - GelmanNeeman theory - Quark model - SU3 symmetry - unification of fundamental interactions - CPT invariance and applications of symmetry arguments to particle reaction, parity non conservation in week interaction.

Unit V: ASTROPHYSICS AND RADIO ASTRONOMY (15 Hrs)

Physical properties of stars - life cycle of a star - end products of Stellar evolution - structure of milky way - expanding universe - future prospects - Radio astronomy - radio telescopes - Synchrotron radiation - spectral lines in radio astronomy - a few major discoveries in radio astronomy - Radio astronomy in India - Hot big bang cosmology.

Books for Study

1. S.N. Ghoshal, Nuclear Physics, S. Chand and company Ltd. 2003.
2. Satya Prakash, Nuclear Physics and Particle Physics, Sultan Chand and sons, First edition 2005.
3. Joshi A.W, Horizons of Physics, Willey Eastern Ltd.

Unit	Book	Sections
I	1	2.1 – 2.13, 17.2, 17.3, 17.4, 17.6, 17.8
II	1	4.9 – 4.12, 5.5 – 5.7, 5.9, 5.10, 5.12, 5.16, 5.18, 6.8 – 6.11, 6.16, 6.19
III	2	8.1, 8.2, 8.4, 8.5, 8.7, 8.10, 8.12, 8.13, 8.15, 8.16, 9.2, 9.4, 9.11, 9.12, 9.13, 9.17, 9.21
IV	2	11.4 – 11.14, 11.15, 11.16.
V	3	Chapters 14 & 15

Books for Reference

1. Kenneth S. Krane - Introductory Nuclear Physics, John Wiley and Sons, New York, 1988.
2. Joshi A.W - Nuclear Physics, Gujarat UmeshPrahasham.
3. Pandya and Yadav - Nuclear and Particle Physics world, Cambridge University Press.
4. Bernard L. Cohen - Concepts of Nuclear Physics, Tata McGraw Hill Publishing Co., New Delhi.
5. Irwing Kaplan, Nuclear Physics, Addison-Wesley Pub. Company, 2nd edition.

Semester-IV **Hours/Week: 6**
16PPH4113 **Credit : 6**

CONDENSED MATTER PHYSICS

Assurance of Learning

The students will learn the following after going through this course

- The crystal structure and imperfections
- The lattice vibration and thermal properties
- The properties and related theories of solids

UNIT-I Packing of atoms in crystal, diffraction and imperfections in crystals (15 Hrs)

Packing and Close packing of equal spheres in 3 dimensions-classification of close Packing- axial ratio and lattice constants- voids in close packing-size and coordination of voids-significance of voids- X-ray diffraction-Laue equations-interpretation of Bragg's equation-Ewald construction-reciprocal lattice-properties of reciprocal lattice- X-ray diffraction experiment-powder method point imperfections- line imperfections-surface imperfection-

UNIT-II Thermal properties of Solids (15 Hrs)

Dynamics of chain of identical atoms-dynamics of diatomic linear chain-Fick's first and second law of diffusion-diffusion mechanisms-Kirkendall effect-Einstein and Debye model for specific heat capacity-thermal conductivity of solids-thermal conductivity due to electrons and phonons-thermal resistance of solids- anharmonicity and thermal expansion.

UNIT-III Conductors and Superconductors (15 Hrs)

Electrical conductivity and ohms law-Wiedemann-Franz –Lorentz law-electrical resisitivity of metals-nearly free electron model-Tight binding approximation-Fermi surface and Brillouin zones-Characteristics of Fermi surfaces-efect of electric field and magnetic field on Fermi surface-experimental study of Fermi surfaces(anomalous skin effect, cyclotron resonance,de Hass-van Alphen effect)-Meissner effect-thermodynamics of superconducting transitions-London equations-London penetration depth-coherence length-BCS theory-Josephson effect.

UNIT-IV Semiconductors and dielectrics (15 Hrs)

Carrier concentration in semiconductors- Fermi level and carrier concentration in semiconductors-mobility of charge carriers- effect of temperature on mobility-electrical conductivity in semiconductors-Hall effect in semiconductors-Junction properties- Local electric field at an atom- dielectric constant and its measurement-polarizability-classical theory of electronic polarizability-dipolar polarisability- piezo-pyro ferro electric properties of crystals-ferroelectricity.

UNIT-V Magnetic properties of solids **(15 Hrs)**

Origin of permanent magnetic moments-Langevin's classical theory of diamagnetism and paramagnetism-Quantum theory of paramagnetism-Ferromagnetism – Weiss molecular field-Temperature dependence of spontaneous magnetization-ferromagnetic domain-domain theory-Antiferromagnetism- Ferrimagnetism and ferrites

Book for Study:

1. Wahab M.A. , Solid state Physics ,2nd edition, Narosa publishing house, India, 2010.

Units	Book	Sections
I	**1**	**3.2, 3.3 – 3.8, 8.6, 8.7, 8.9 – 8.13, 8.15, 8.16, 5.2, 5.4, 5.12**
II	**1**	**6.2, 6.3, 6.6, 6.8, 7.2, 7.3, 7.6, 9.4, 9.6 – 9.10**
III	**1**	**10.11, 10.13, 11.7, 11.8, 12.2, 12.5 – 12.7, 12.9, 17.4, 17.5, 17.8 – 17.11, 17.13**
IV	**1**	**13.2 – 13.8, 14.5 – 14.11**
V	**1**	**16.6 – 16.10, 16.12 – 16.14, 16.16 – 16.19**

Semester: IV **Hours: 8**
16PPH 4114 **Credit: 4**

Core: 14 PHYSICS PRACTICALS – IV

Assurance of Learning

The students will learn the following after going through this course

- Various techniques and concepts in Electronics
- Various techniques and concepts in General Physics experiments
- Develop the skill in handling instruments.

1	AlO Band
2	Microwave – Gunn oscillator
3	Laser IV : Fibre Optics
4	Op-amp: Solving I order Simultaneous Equation
5	Analog to Digital Converter
6	RAM – Construction and Study
7	Design of Synchronous Counter
8	Digital Comparator IC based
9	555 – Bistable MV, Schmitt Trigger
10	Digital Modulation: ASK, FSK
11	Resistivity by Four Probe Method
12	μP – Programming-III:
13	μP – Programming-IV: Digital Clock
14	μP – Interfacing – IV: Display of Character
15	μP – Interfacing - V: Waveform gen
16	μP – Interfacing – VI: Frequency measurement
17	One shot MV using IC 7421 & TTL clock using digital ICs
18	MC – Programming & Interfacing - III
19	MC – Programming & Interfacing - IV
20	Computer: Numerical Problem - IV
21	MC- Programming with C Simulator - II
22	Electron Spin Resonance Spectrometer

Semester – IV **Hours/Week: 4**
16PPH4203A **Credit : 4**

NANOSCIENCE AND NANOTECHNOLOGY

Unit 1: BACKGROUND AND TYPES OF NANOMATERIALS

Historical perspective of nanomaterials - Scientific revolution – Emergence of Nanotechnology – Challenges in Nanotechnology – Types of nanomaterials - One Dimensional (1D)-Two Dimensional(2D) -Three Dimensional (3D) nanostructured materials - Quantum dots - Quantum wire.

UNIT II - SYNTHESIS OF NANO MATERIALS

Ball Milling – Electrodeposition - Spray Pyrolysis - Pulsed Laser Deposition (PLD) – DC/RF Magnetron Sputtering - Molecular Beam Epitaxy (MBE), Sol-Gel Process – Reverse Micelles and Micro emulsions - Chemical Vapor Deposition (CVD)

UNIT III - CHARACTERIZATION OF NANOMATERIALS

X-ray diffraction - Debye-Scherer formula – Electron microscopes: scanning electron microscope (SEM) – transmission electron microscope (TEM); atomic force microscope(AFM) – scanning tunneling microscope (STM) – Working Principle, Instrumentation and Application - Photoluminescence (PL) Spectroscopy.

UNIT IV - MEMS NANO TECHNOLOGY

Top down approach – bottom up approach – types of GMR – applications of GMR, MEMS materials – MEMS processes – MEMS applications. NEMS – applications of NEMS – nano quantum limit – benefits of nanomachines – nano sensors.

UNIT V: APPLICATIONS OF NANOMATERIALS

Molecular electronics and nanoelectronics – Quantum electronic devices - CNT based transistor and Field Emission Display - Membrane based water purification – drug delivery system - nanobiotechnology

Book for Study

1. A Hand book on Nanotechnology – A.G. Brecket, 1st Edition 2008, Dominant publishers and distributors, New Delhi.
2. Origin and Development of Nanotechnology – P.K. Sharma, 1st Edition 2008, Vista International Publishing House, New Delhi.
3. Nano Science and Nano Technology – K.P. Mathur, 1st Edition 2007, Rajat Publications, New Delhi.
4. Nanocrystals: Synthesis, Properties and Applications, C. N. R. Rao, P. J. Thomas and G. U.Kulkarni, Springer (2007).
5. Nanostructures & Nanomaterials: Synthesis, Properties & Applications, Guozhong Gao, Imperial College Press (2004).
6. M. Wilson, K. Kannangara, G Smith, M. Simmons, B. Raguse, Nanotechnology: Basic science and Emerging technologies, Overseas Press India Pvt Ltd, New Delhi, First Edition, 2005.

Sem.IV **Hours/Week: 4**
16PPH4203B **Credits: 4**

Core Elective-3B:
DIGITALPHOTOGRAPHY

Assurance of Learning

The students will learn the following after going through this course

- The students know features of the Digital Camera.
- The students know how to use Photoshop for Basic and Advanced Techniques
- The students know how to handle Digital and Video Cameras.
- The students know how to mix the Video and Audio.

UnitI: THE DIGITAL CAMERA AND LENSES (10 Hrs)

Digital Camera features - Types of Digital Camera - Memory and Memory Cards; Lenses; Zoom Lenses - Fixed Lenses - Changing Lenses; Computer - getting connected - Software and Printer.

UnitII :PHOTO TECHNIQUES AND IDEAS (10 Hrs)

Composition - Focus - Depth of field - exposure - white Balance; Creative Flash - low light - Portraits and People - Travel - Architecture - Weddings Sports and Action.

UnitIII: BASIC DIGITAL TECHNIQUES – PHOTOSHOP (10 Hrs)

Starting to use Editing Software - Saving the photos - Cropping – Straitening - Resizing - Sharpening - Brightening and Darkening Photos – Removing Red eye – Practicals

UnitIV: ADVANCED DIGITAL TECHNIQUES – PHOTOSHOP (10 Hrs)

Colour Management - Adjusting Colours - Controlling Colour and Brightness - Cloning and Healing - Dodge and Burn - Layers - Adding Text with layers - Making Panoramas - Special effects – Practicals

UnitV: DIGITAL VIDEOGRAPHY (10 Hrs)

Video Cameras - Colour Video Systems - Types of picture tubes – Block diagram of a Video camera and their parts - Video and Audio mixing using software - Precautions for the use of a Video camera - PC Digital Video and its applications.

Books for Study

1. Doug Harman, The Digital Photography Handbook, Quercus Publishing Ltd., 2010.
2. Arch C. Luther, Using Digital Videos, AP Professional, Cambridge, 1998.