M.Sc. PHYSICS

SEM	COURSE CODE	COURSE	COURSE TITLE	HRS/ WEEK	CREDIT	CIA MARKS	SE MARKS	TOTAL MARKS
I	14PPH1C1	CORE I	Classical Dynamics	6	5	40	60	100
	14PPH1C2	CORE II	Mathematical Methods for Physics	6	5	40	60	100
	14PPH1C3	CORE III	Nuclear and Particle Physics	6	5	40	60	100
	14PPH1C4P1	CORE IV	General Physics - Practical	3	3	20	30	50
	14PPH1C4P2	CORE IV	Optics and Heat - Practical	3	2	20	30	50
	14PPH1CE1	CORE BASED ELECTIVE – I #		6	5	40	60	100
TOTAL				**30**	**25**	**200**	**300**	**500**
II	14PPH2C5	CORE V	Advanced Mathematical Physics	6	5	40	60	100
	14PPH2C6	CORE VI	Electronics Devices and Circuits	6	5	40	60	100
	14PPH2C7	CORE VII	Electromagnetic Theory	6	5	40	60	100
	14PPH2C8P1	CORE VIII	Solid State Physics - Practical	3	3	20	30	50
	14PPH2C8P2	CORE VIII	Analog Electronics - Practical	3	2	20	30	50
	14PPH2CE2	CORE BASED ELECTIVE – II #		6	5	40	60	100
TOTAL				**30**	**25**	**200**	**300**	**500**
III	14PPH3C9	CORE IX	Atomic and Molecular Spectroscopy	6	5	40	60	100
	14PPH3C10	CORE X	Quantum Mechanics	6	5	40	60	100
	14PPH3C11	CORE XI	Statistical Mechanics	6	5	40	60	100
	14PPH3C12P1	CORE XII	Digital Electronics Practical	3	3	20	30	50
	14PPH3C12P2	CORE XII	Numerical Programming in Physics - Practical	3	2	20	30	50
	14PPH3CE3	CORE BASED ELECTIVE – III #		6	5	40	60	100
	14PPH3EC1	EXTRA CREDIT – I	Nonlinear Electronics	-	5*	--	100*	100*
TOTAL				**30**	**25**	**200**	**300**	**500**
IV	14PPH4C13	CORE XIII	Solid State Physics	6	5	40	60	100
	14PPH4C14P1	CORE XIV	Microprocessor& Microcontroller- Practical	3	3	20	30	50
	14PPH4C14P2	CORE XIV	Numerical Simulations in Physics: - Practical	3	2	20	30	50
	14PPH4EC2	EXTRA CREDIT – II	Non-Conventional Energy Sources	-	5*	--	100*	100*
	14PPH4PW	PROJECT WORK		18	5	40	60	100
TOTAL				**30**	**15**	**120**	**180**	**300**
GRAND TOTAL				**120**	**90**	**720**	**1080**	**1800**

Core Based Electives

SEMESTER	CORE BASED ELECTIVE
I	Medical Physics &Ultrasonics
	Crystal Growth and Thin Films
II	Computational Methods for Physics
	Nano science and Technology
III	Special Electronics
	Electronic Instrumentation

* Not considered for Grand Total and CGPA

SEMESTER I: CORE – I
CLASSICAL DYNAMICS

Course Code : 14PPH1C1 **Max.Marks : 100**
Hours / Week : 6 **Internal Marks : 40**
Credit : 5 **External Marks : 60**

Objectives:

- To understand Lagrangian and Hamiltonian principles and its applications
- To study thecanonical transformations of Poisson's Brackets & Hamilton – Jacobi Theory
- To study the general theory of small oscillations and Rigid body dynamics
- To study the energy concepts in relativistic mechanics.

UNIT – I Lagrangian Dynamics 18 hours

Constraints – generalized co-ordinates – principle of virtual work – D'Alembert's principle – Lagrange's equations from D'Alembert's principle – Hamilton's principle and Lagrange's equations – Applications – simple pendulum – At wood's machine – Bead sliding on rotating wire in a force – **#**free space**#**.

UNIT - II Hamiltonian Dynamics 18 hours

Cyclic co-ordinates – Hamilton's canonical equations of motion – deduction of Hamilton's principle from the D'Alembert's principle – Deduction of Hamilton's equation from the modified Hamilton's principle – principle of least action – Examples: Motion of a particle in a central force field, charged particle moving in an electromagnetic field.

UNIT - III Poisson's Brackets & Hamilton – Jacobi Theory 18 hours

Poisson's bracket – canonical transformations – invariance of Poisson bracket with respect to canonical transformations – Hamilton-Jacobi theory – Action and Angle variable – Kepler's problem – solution of Harmonic oscillator problem by Hamilton-Jacobi equation – Hamilton's characteristic function conservative system.

UNIT – IV Small oscillations and Rigid-body dynamics 18 hours

General theory of small oscillation – Equation of motion for small oscillation – solution of eigen value equation – normal co-ordinates and normal frequencies of vibration – vibration of a linear triatomic molecule.

Euler's angle – equation of motion of Rigid body – Euler's equations – the motion of a symmetric top under action of gravity.

UNIT – V Relativistic Mechanics 18 hours

Relativistic energy – relation between momentum and energy and conservation law – transformation of momentum and energy – Force in relativistic mechanics – Minkowski space and Lorentz transformations – **#**World point and world line**#** – Four vectors.

#.....#Self study portion

Text book

J.C. Updhaya,Classical Mechanics,,Himalaya Publishing House, 2nd edition,2003

UNIT I	**Chapter 2**	**Sections 2.3-2.11**
UNIT II	**Chapter 3 & 5**	**Sections 3.2 - 3.5 & 5.3 -5.11**
UNIT III	**Chapter 7 & 8**	**Sections 7.2 - 7.6 & 8.2 -8.8**
UNIT IV	**Chapter 9 & 10**	**Sections 9.4 - 9.6 & 10.3 -10.14**
UNIT V	**Chapter 13 & 14**	**Sections 13.3 -13.8 & 14.2 -14.5**

Books for reference:

1. H.Goldstain,Classical Mechanics,NarosaPublishing, 2nd edition, 2008
2. N.C.Rana and P.S.Joag,Classical Mechanics, Tata McGraw. Hill, 1stedition, 1991.

MATHEMATICAL METHODS FOR PHYSICS

Course Code : 14PPH1C2 | **Max.Marks : 100**
Hours / Week : 6 | **Internal Marks : 40**
Credit : 5 | **External Marks : 60**

Objective:

- To practice mathematical methods for physics through vector analysis, matrices, Tensors, complex variable, Fourier transform

UNIT – I Vector Analysis **18 hours**

Differentiation of Vector Functions: The Derivative of a Vector- Gradient, Divergence, Curl and #Laplacian Operators# - Integration of Vector Functions: Line integral- Gauss Divergence Theorem – Green's theorem – Stoke's theorem – Statements and proofs only.

General Curvilinear Coordinates: Orthogonal Curvlinear Cylindrical Coordinates-Gradient, Divergence, Curl and Laplacianin OrthogonalCurvlinear Coordinates - Spherical Polar coordinates.

UNIT - II Linear Vector Spaces and Matrices **18 hours**

Linear Vector Spaces**:** Definition – Linear independence, basis and dimension – Scalar Product-Orthonormal basis- Schwartz Inequality-Gram-Schmidt's Orthogonalization process – Linear operators

Special Types of Matrices: The Eigen Value Problem-Cayley Hamilton theorem –Coordinate Transformations: Rotation in two and Three Dimensions.

UNIT - III Tensors **18 hours**

Contravariant vector –covariant vector –Tensors of second rank –General Definition -addition and subtraction - outer products of tensors – Inner products of tensors – symmetric and anti symmetric tensors – Quotient Law - Kronecker Delta – Metric tensor – Orthogonal Transformations- Stress and Strain tensors-Hooke's law – moment of inertia tensor

UNIT – IV Complex Variables **18 hours**

The Derivative of a Complex Function $f(z)$ of its Analyticity – Cauchy – Riemann conditions – Harmonic Functions- Cauchy's Integral theorem - Cauchy's Integral formula – Taylor's series – Laurent's series – Zeros of a Complex Function-Evaluation of Residues-Cauchy Residue theorem – Cauchy Principal Value -Evaluation of definite integrals [Integrals of the form $\int_0^{2\pi} f(sin\theta, cos\theta)d\theta$ and $\int_{-\infty}^{+\infty} f(x)dx$]

UNIT – V Fourier Transforms **18 hours**

Fourier Integral Theorem and its proof- Fourier transform of time dependent functions-Integral Representation of the Dirac Delta Function-Parseval's Theorem-Linearity Theorem- Fourier transform of derivatives –Shifting of the origin- Convolution theorem – Sampling Theorem-**#**Use of Fourier Transforms in Solving Differential Equations**#**

#.....#Self study portion

Text books

T.B 1 Charlie Harper, Introduction to Mathematical Physics, PHI, New Delhi, 2nd edition,2006.
T.B 2 A.W. Joshi, Matrices and Tensors in Physics, New Age International, NewDelhi, 1st edition,1995
T.B 3 A.K. Ghatak, I.C. Goyal& S.J. Chua, Mathematical Physics, Macmillman India Ltd, New Delhi,1st edition,1995

UNIT I	**Chapter 1**	**Sections 1.3.1 - 1.6.8**	**T.B 1**
UNIT II	**Chapter 2 & 7**	**Sections 2.5 - 2.9 & 7.1 -7.6**	**T.B 1**
UNIT III	**Chapter 15 -19**	**Sections 15.2 - 19.7**	**T.B 2**
UNIT IV	**Chapter 3 &4**	**Sections 3.3.1 – 4.6.2**	**T.B 1**
UNIT V	**Chapter 10**	**Sections 10.1 - 10.10**	**T.B 3**

Book for reference:

B.D. Gupta, Mathematical Physics, Vikas Publications, 3rd edition,2005

SEMESTER I: CORE – III
NUCLEAR AND PARTICLE PHYSICS

Course Code : 14PPH1C3 **Max.Marks : 100**
Hours / Week : 6 **Internal Marks : 40**

Credit : 5 **External Marks : 60**

Objectives:

- To understand the properties and models of nucleus
- To study about nuclear radioactivity and reactions
- To study aboutthe properties of elementary particles

UNIT – I General properties of Atomic Nucleus 18 hours

Binding energy – semi empirical mass formula – optical model – shell model: **#**evidence for the existence of magic numbers**#** – extreme single particle model – spin orbit potential.

Nuclear Forces: Exchange forces – Yukawa potential – ground state of deuteron – low energy n-p scattering - scattering length – phase shift – effective range theory.

UNIT - II Radioactive Decays 18 hours

Alpha decay – Gamow's theory of Alpha decay – Geiger nuttal law – neutrino hypothesis – Fermi's theory of beta decay – selection rules – Wu's experiment – non conversion of parity in beta decay – parity in β – decay – gamma decay – selection rules – internal conversion –**#**nuclear isomerism**#**.

UNIT - III Nuclear Fission and Fusion 18 hours

Types of Fission – distribution of Fission products – Nuclear chain reactions – Four factor formula – Bohr-Wheeler's theory of nuclear fission – liquid drop model.

Nuclear Fusion – Thermo nuclear reactions as source of stellar energy – controlled thermo nuclear reactions – Plasma confinement.

UNIT – IV Nuclear reaction 18 hours

Nuclear reaction kinematics – general solution of the Q-equation – Nuclear reaction crosssections – the compound nucleus – reciprocity theorem – Direct reactions – Stripping reactions – Partial wave analysis of nuclear reaction cross sections – Breit-Wigner dispersion formula for $l = 0$ neutrons.

UNIT – V Elementary particles 18 hours

Classification of elementary particle -**#**fundamental interactions**#** – conservation laws and their validity – the C-P-T theorem – Properties of elementary particles: the Massless Bosons – the Leptons –

the mesons – symmetry schemes of elementary particles – SU(3) multiplets of Hardons – Gellmann – Okubo mass formula for SU(3) multiplets – Quarks. Flavours and colours.

#.....#Self study portion

Text book

D.C. Tayal, Nuclear Physics, Himalaya Publishing House, New Delhi, 2nd edition, 2011

UNIT I	**Chapter 1, 8 - 10**	**Sections 1.6 - 1.7 & 8.3 - 10.21**
UNIT II	**Chapter 5 - 7**	**Sections 5.4 - 7.6**
UNIT III	**Chapter 13**	**Sections 13.1 - 13.2**
UNIT IV	**Chapter 10**	**Sections 10.3 - 10.24**
UNIT V	**Chapter 18**	**Sections 18.1 - 18.3**

Books for reference:

1. M.L. Pandya, R.P.S. Yadav,Elements of nuclear Physics, KedarNath Ram Nath, New Delhi, 4th edition, 2011.
2. Satya Prakash,Nuclear & Particle Physics, Sultan Chand & Sons, New Delhi, 4th edition, 2010

SEMESTER I: CORE – IV
GENERAL PHYSICS - PRACTICAL

Course Code : 14PPH1C4P1 **Max.Marks : 50**

Hours / Week : 3 **Internal Marks : 20**
Credit : 3 **External Marks : 30**

Objectives:

- To realize the physics principles through advanced physics experiments
- To determine a physical coefficients through electromagnetic and optical experiments.

1. e/m Thomson method
2. e/m Helical method
3. Determination of the specific charge [e/m] of an electron by magnetron method.
4. Determination of q, n, σ by elliptical fringes method.
5. Determination of Specific Rotatory Power of Liquids - Lauret's Half-shade Polarimeter
6. Fourier Analysis of Periodic Waveforms
7. Determination of magnetic susceptibility by Quinke's method.
8. Determination of λ and μ using Fresnel Bi-prism.

Book for reference:

S.P.Singh, Advanced Practical Physics, A PragathiPrakashan, 1st edition, 2011.

SEMESTER I: CORE – IV
OPTICS AND HEAT - PRACTICAL

Course Code : 14PPH1C4P2 **Max.Marks : 50**
Hours / Week : 3 **Internal Marks : 20**
Credit : 2 **External Marks : 30**

Objective:

- To develop the skills in measuring physical quantities and determining coefficients through optics and heat experiments.

1. Determination of wavelength and $\Delta\lambda$ using Michelson's interferometer.
2. Determination of q, n, σ by Hyperbolic fringes method.
3. Rydberg's Constant – Hydrogen Spectrum.
4. Charge of an electron by spectrometer.
5. Determination of Stefan's constant.
6. Lorentz number determination – Forbe's method.
7. Ultrasonic Diffraction – Bulk modulus.
8. Magnetic Susceptibility of a liquid - Guoy's Method.

Book for reference:

S.P.Singh, Advanced Practical Physics, A PragathiPrakashan, 1st edition, 2011.

SEMESTER I: CORE BASED ELECTIVE – I
MEDICAL PHYSICS AND ULTRASONICS

Course Code	**: 14PPH1CE1**	**Max.Marks**	**: 100**
Hours / Week	**: 6**	**Internal Marks**	**: 40**
Credit	**: 5**	**External Marks**	**: 60**

Objectives:

- To acquire knowledge in biomedical instrumentation
- To learn the applications of Laser and Ultrasonics in Medicine

UNIT – I Diagnostic Devices 18 hours

Blood Pressure and its Measurement – Eye Pressure Measurement - Electrical Signals from Heart: Electrocardiography (ECG) – Electrical Signals from brain: Electroencephalogram (EEG) - Electrical Signal from muscles: Electromyogram (EMG) – Magnetic Resonance Imaging (MRI).

UNIT - II Therapeutic Devices 18 hours

Microprocessor based ventilators – AC and DC defibrillator – Pacemaker – Versatile Electro Therapeutic Stimulator – Anesthesia Machine – Ventilator – Dialysis Process – Comparison between Hemodialysis and Peritoneal Dialysis - Peritoneal Dialysis unit - Nuclear Therapy: Tele-Therapy (Co^{60}) and Brachytherapy.

UNIT - III Medical Applications of Lasers 18 hours

Laser Based Blood Cell Counter – Laser Doppler Blood Flow meter – Laser in Angioplasty – Principle and theory of fluorescence – Reflectance and Light Scattering Spectroscopy – Laser Spectroscopy Cancer Detection Techniques: Fluorescence and Raman Spectroscopy – Photodynamic Therapy of Tumors.

UNIT – IV Ultrasonic Study of Liquid Mixtures and Solutions 18 hours

Preparation of multi component liquid mixtures:#Mole fraction – Weight fraction**#** – Volume fraction. Measurement techniques: Ultrasonic Interferometer – Continuous wave method – Density – Viscosity

Pure liquids and binary Mixtures :Free Length Theory – Collision Factor Theory – Nomoto's Relation Acoustical Parameters – Adiabatic Compressibility – Acoustic Impedance – Intermolecular Free Length – Molar Volume – Free Volume – Internal Pressure.

UNIT – VApplications of Ultrasound 18 hours

Low Frequency – High Intensity Applications: Ultrasonic Welding – **#**Applications**#** – Ultrasonic Cleaning – Applications – Food Industry – Length Meters.

High Frequency – Low Intensity Applications: Level Meters – Thickness Measurements – Ultrasonic Microscopy – Acoustic Holography (Transmission Acoustic Holography)

#.....# Self study portion

Text books:

T.B 1 Dr .M. Arumugam,Biomedical Instrumentation, Anuradha publications, Chennai, ,10th Reprint 2005.

T.B 2 S.Svanberg, Atomic & Molecular Spectroscopy (Basic aspects & Practical applications), WILY Publications, 4th Edition 2010.

T.B 3 Baldevraj, V.Rajendran and P.Palanichamy, Science and Technology of Ultrasonics, Narosa Publications, New Delhi, 4th Edition 2009.

Unit I	**Chapter 4 & 10**	**Sections 4.3 – 4.8 & 10.10.3 – 10.10.8**	**T.B 1**
Unit II	**Chapter 5 & 6**	**Sections 5.5.1 – 6.9**	**T.B 1**
Unit III	**Chapter 10**	**Sections 10.5 – 10.5.4**	**T.B 2**
Unit IV	**Chapter 6**	**Sections 6.1 – 6.8.8**	**T.B 3**
Unit V	**Chapter 5**	**Sections 5.3 – 5.4.3**	**T.B 3**

Book for Reference:

John R. Cameron and James G.Skofronick, Medical Physics, John Wiley Interscience Publication, Canada, 2nd edition, 2009.

SEMESTER I: CORE BASED ELECTIVE – I
CRYSTAL GROWTH AND THIN FILMS

Course Code : 14PPH1CE1 **Max.Marks : 100**
Hours / Week : 6 **Internal Marks : 40**
Credit : 5 **External Marks : 60**

Objectives:

- To learn the crystal growth and characterization techniques
- To study the formation of thin film and its analysis

UNIT – I Crystal growth Phenomena 18 hours

Nucleation: Theories of nucleation – Classical theory of nucleation: Gibbs Thomson equation for vapour – Gibbs-Thomson equation for solution – Energy formation of a nucleus – Spherical nucleus – #Cylindrical nucleus#

UNIT - II Low Temperature Solution growth 18 hours

#Solution, Solubility and Super solubility# – Expression of Super saturation – Methods of Crystallization: Crystallization by Slow Cooling of Solutions – Crystallization by Slow evaporation Method – Temperature gradient Method – Crystal growth system.

UNIT - III Other Crystal growth techniques 18 hours

Physical vapour deposition – Chemical vapour deposition – Gel growth – Principle of gel growth – various types of gel – Structure of gel – Growth of Crystals in gels – Importance of gel technique – Experimental procedure.

UNIT – IV Methods of Thin film 18 hours

Chemical vapour deposition – Pyrolysis – Vapour phase reaction – Vapour Transportation method – Disproportionation method – Chemical deposition – Electrodoposition – Mass method (Micro balance technique) – Optical method (Photometric).

UNIT – V Thin film Analysis 18 hours

Electron Diffraction Technique – Electron Microscopy – Scanning Electron Microscopy (SEM) – Electron Probe micro analysis – X-Ray Photo Electron spectroscopy (XPES) – Mass Spectroscopy.

#.....# Self study portion

Text Books

T.B 1 Dr. P. SanthanaRaghavan and Dr. P. Ramasamy, Crystal Growth, KRU Publications, 1st edition.

T.B 2 A. Goswami,Thin Film Fundamentals, New Age International Publishers, Reprint,2008

Unit I	**Chapter 2**	**Sections 2.2 - 2.26**	**T.B 1**
Unit II	**Chapter 4**	**Sections:4.11 -4.21**	**T.B 1**

Unit III	**Chapter 5**	**Sections: 5.1 - 5.4.61**	**T.B 1**
Unit IV	**Chapter 9**	**Sections: 9.1 - 9.72**	**T.B 2**
Unit V	**Chapter 7**	**Sections: 7.17 -7.25**	**T.B 2**

Books for reference:

1. J.W. Mullin, "Crystallization", Butterwort*hs, London,* Second edition, *1972.*
2. P.Hortman, "Crystal growth an introduction", North Holland publishing Co, Amsterdam, Second edition 1965.
3. H.K.Henish, "Crystal growth from gel", ThePennsylvania state university, First edition,1969.
4. P.Ramasamy, "Recent trends in Crystal growth", ICSU- COSTED Publications, Madras, First edition, 1988.
5. B.R.Pamplin, "Crystal Growth",Pergamon press, London, Second edition 1980.

SEMESTER II: CORE – V
ADVANCED MATHEMATICAL PHYSICS

Course Code	**: 14PPH2C5**	**Max.Marks**	**: 100**
Hours / Week	**: 6**	**Internal Marks**	**: 40**
Credit	**: 5**	**External Marks**	**: 60**

Objectives:

- To learn the mathematical functions and problem practice
- To learn the concept of group theory

UNIT – I Partial Differential Equations 18 hours

Importance of partial differential equations – method of separation of variables – solution of one-dimensional wave equation – one dimensional heat conduction equation – modes of an optical fiber – transformation and **#**classification of PDE's**#** – characteristic co-ordinates – canonical forms of hyperbolic, parabolic and elliptic equations.

UNIT - II The Beta, Gamma and special functions 18 hours

Definition of the Beta function and Gamma function – symmetry property of Beta function – Transformation of Beta function – Transformation of Gamma function – Relation between Beta and Gamma functions – Legendre differential equation – Hermite differential equation – generating function – Rodrigue's formula– orthogonal properties – Bessel's differential equation – Recurrence formula for $J_n(x)$.

UNIT - III Dirac-Delta function and Green's Function 18 hours

Dirac-Delta function – Properties of Delta function – three dimensional delta function – Green's function for one-dimensional case – Application to Boundary value problem – general proof of symmetry property of Green's function – Green's function for Poisson's equation and solution of Poisson's equation – Green's function for quantum mechanical scattering problem.

UNIT – IV Laplace's Integral transform 18 hours

Condition for the existence of Laplace transform – **#**Properties of Laplace transform**#** – Laplace transform of derivative of a function – Laplace transform of integral – Laplace transform of special function – evaluation of inverse Laplace transform – convolution theorem.

UNIT – V Group theory 18 hours

Concept of a group – Abelian group – the cyclic group – the group multiplication table – Rearrangement theorem – Isomorphism and Homomorphism – the group of symmetry of an equilateral triangle – group of symmetry of a square – representation of groups – reducible and irreducible representations – Schur's Lemma I and II – The orthogonality theorem.

#.....#Self study portion

Text books

T.B 1 A.K. Ghatak,I.C. Goyal& S.J. Chua, Mathematical Physics, Macmillman India Ltd, New Delhi, 1st edition,1995.

T.B 2 Satya Prakash, Mathematical Physics, Sulthan Chand and Sons, New Delhi, 3rd edition, 2001

UNIT I	**Chapter 15**	**Sections 15.2 - 15.7**	**T.B 1**
UNIT II	**Chapter 4& 7**	**Sections 4.1 - 4.7 & 7.11 -7.40**	**T.B 2**
UNIT III	**Chapter 11**	**Sections 11.1 - 11.13**	**T.B 2**
UNIT IV	**Chapter 9**	**Sections 9.9 - 9.24**	**T.B 2**
UNIT V	**Chapter 13**	**Sections 13.1 - 13.21**	**T.B 2**

Book for reference:

Charlie Harper, Introduction to Mathematical Physics, PHI, New Delhi, 2nd edition, 2006.

SEMESTER II: CORE – VI
ELECTRONICS DEVICES AND CIRCUITS

Course Code : 14PPH2C6 | **Max.Marks : 100**
Hours / Week : 6 | **Internal Marks : 40**
Credit : 5 | **External Marks : 60**

Objectives:

- To study the fabrication of semiconductor devices
- To study the constructions, operations and characteristics of solid state devices
- To learn the circuit ideas of Op-amp and 555 timer applications.

UNIT – I IC Fabrication and Transducers **18 hours**

Introduction – Construction of Monolithic bipolar transistors – Fabrication of PNP transistors – Fabrication of Monolithic Diodes, Resistors, Capacitors and Inductors – Fabrication of Junction Field Effect Transistors and MOSFET – NMOS fabrication.

UNIT –II Solid State Devices 18 hours

Construction, operation and V-I characteristics of special devices: Tunnel diode – Gunn diode – MOSFET – Enhancement MOSFET – Biasing of Enhancement MOSFET.

SCR – SCR half wave rectifier – SCR Full wave rectifier – **#**TRIAC**#** – DIAC – UJT – UJT relaxation Oscillator

UNIT - III Operational Amplifier 18 hours

Instrumentation Amplifier – Op-Amp circuits using diodes: Half wave rectifier, Full wave rectifier, Peak detector, Clipper and Clamper circuits – Sample and hold circuit – Logarithmic and Antilogarithmic amplifier.

Multiplier – Divider – Differentiator – Integrator –Electronic analog computation: Simulation of 2^{nd} order differential equation – simulation of transfer function

UNIT – IV Comparators, Waveform Generators and Filters 18 hours

Comparator – Zero crossing detector – window detector – Schmitt trigger – Astablemultivibrator – MonostableMultivibrator – Triangular wave generator.

RC phase shift oscillator – Wien's bridge oscillator – Function generator – RC active filters: I order low pass, high pass and band pass filters.

UNIT – V 555 Timer and Phase –Locked Loops PLL 18 hours

Introduction – Description of functional diagram of 555 timer – Monostable operation – Frequency divider – Astable operation – Frequency Shift Keying(FSK) generator.

PLL Basic principle – Analog phase detector – Digital phase detector – Voltage controlled oscillator – **#**PLL applications**#** – frequency multiplication/division – Frequency Translation

#.....#Self study portion

Text books

T.B 1 S Salivahanan, N Suersh Kumar & A Vallavaraj, Electronic Devices and Circuits, Tata

McGraw-Hill Publishing Company Limited, New Delhi,Second Edition, 2009.

T.B 2 D.RoyChoudhury and ShailB.Jain, Linear Integrated Circuits, New Age International Publishers,third edition, 2012.

UNIT I	**Chapter 19**	**Sections 19.1 - 19.12.2**	**T.B 1**
UNIT II	**Chapter 5,7,8& 17**	**Sections 5.8, 7.9 - 8.8 & 17.2**	**T.B 1**
UNIT III	**Chapter 5**	**Sections 5.1 - 5.9**	**T.B 2**
UNIT IV	**Chapter 8**	**Sections 8.1 - 8.7**	**T.B 2**
UNIT V	**Chapter 14**	**Sections 14.4 - 14.9**	**T.B 2**

Book for reference:

V.Vijayendran,Introduction to Integratedelectronics(Digital&Analog), S.Viswanathan, Printers &PublishersPrivate Ltd, Reprint 2008.

SEMESTER II: CORE – VII
ELECTROMAGNETIC THEORY

Course Code : 14PPH2C7 | **Max.Marks : 100**
Hours / Week : 6 | **Internal Marks : 40**
Credit : 5 | **External Marks : 60**

Objectives:

- To understand the concepts of electro and magnetic statics
- To study the principles and properties of electromagnetic wave

UNIT – I Electrostatics **18 hours**

Coulomb's Law: Discrete and continuous charge distribution – electric potential – Gauss's law (or $div\,\vec{E}$) – Possion's equation and Laplace equation - Multipole expansion of charge distribution – Dielectric and its polarization –**#**Electric displacement**#** – Dielectric constant.

Polarisibility(α): Electronic, Ionic, dipolar – polarization of non-polar molecules: Lorentz equation for molecular field, Clausius – Mosotti relation.

UNIT - II Magneto statics 18 hours

#Definition for current density J**#** – Biot-Savart law (Laplace formula) – Applications: Long straight wire, circular coil –Ampere's circuital law (Curl B) –Applications:straight current carrying conductor – Magnetic scalar potential – magnetic vector potential – magnetic energy, derivation.

UNIT - III Electromagnetic waves and propagation 18 hours

Maxwell equations – Propagation of electromagnetic wave in free space – propagation of electromagnetic wave in conducting media (Phase velocity, refractive index, spatial attenuation only) – equation of continuity – displacement current – Poynting's theorem (derivation only)

Wave guide – rectangular wave guide – TM & TE mode.

UNIT – IV Electromagnetic fields and radiating system 18 hours

Electromagnetic potential A and Φ – Maxwell equations in terms of electromagnetic potentials – Non-uniqueness of electromagnetic potentials and concept of gauge – Lorentz gauge – Coulomb Gauge.

Retarded potentials – Lienard-Wiechert potentials.

Oscillating electric dipole – radiation from an oscillating dipole: Vector potential, scalar potential, magnetic induction, Poynting vector and radiated power.

UNIT – V Relativistic electrodynamics 18 hours

Purview of special theory of relativity - 4 vector and tensor – transformation equations for the electromagnetic potentials –transformation equation for the field vectors E and H –covariance of Maxwell equation in 4-tensor form – covariance and transformation law of Lorentz force

#.....#Self study portion

Text book

Chopra &Agarwal,Electromagnetic theory,K.Nath and Co, Meerut, Sixth edition, 2006

UNIT I	**Chapter 1**	**Sections 1.1 - 1.9**
UNIT II	**Chapter 3**	**Sections 3.1 - 3.3**
UNIT III	**Chapter 4 - 6**	**Sections 4.1 - 6.8**
UNIT IV	**Chapter 4, 8 & 9**	**Sections 4.7 - 4.11, 8.1 - 9.2**
UNIT V	**Chapter 10**	**Sections 10.1 - 10.9**

Books for reference:

1. SatyaPrakash,Electromagnetic theory & Electrodynamics, KedarNath Ram Nath and Co, Meerut, 11th Edition, 2005.

2. S.P Puri, Classical electrodynamics, Tata McGraw- Hill Publishing Company Limited, New Delhi, Second Edition,1997.

3. John David Jackson, Classical electrodynamics, John Wiley & Sons, Inc. Third Edition, 1999.

SEMESTER II: CORE – VIII

SOLID STATE PHYSICS - PRACTICAL

Course Code : 14PPH2C8P1
Hours / Week : 3
Credit : 3

Max.Marks : 50
Internal Marks : 20
External Marks : 30

Objectives:

- To develop the skills in measuring physical quantities, determining coefficients for semiconducting materials.
- To realize the magnetic properties of materials.

1. Band gap energy – Four Probe method
2. Determination of carrier concentration and Hall coefficients in semiconductors.
3. Determination of Planck's constant.
4. Di-electric Constant : Determination of the Curie Temperature for a Dielectric Specimen
5. Determination of magnetic susceptibility of powered sample – Guoy's method.
6. Hystersis loop tracer
7. B-H Curve – Determination of the energy loss of a magnetic specimen due to hysteresis using Anchor Ring and Spot Galvanometer
8. g" factor determination – ESR spectrometer

Books for reference:

1. S.P.Singh, Advanced Practical Physics, A PragathiPrakashan,1st edition,2011.
2. S. Philominathan, Advanced Practical Physics & Electronic experiments, PHI, 2nd edition,1998.

SEMESTER II: CORE – VIII

ANALOG ELECTRONICS - PRACTICAL

Course Code	**: 14PPH2C8P2**	**Max.Marks**	**: 50**
Hours / Week	**: 3**	**Internal Marks**	**: 20**
Credit	**: 2**	**External Marks**	**: 30**

Objective:

- To develop the skills analog electronic experiments and to practice the circuit ideas.

1. Characteristics of LDR.
2. Relaxation oscillator using UJT
3. D/A converter – Binary Weighted Method

4. D/A converter – R-2R ladder Network method
5. Filters – low pass, high pass & band pass filters
6. Wien's Bridge Oscillator
7. Verification of Richardson-Dushmann Law: Thermionic Work Function
8. Dielectric Constant using Radio Frequency Hartley Oscillator

Books for reference:

1. S.P.Singh, Advanced Practical Physics, A PragathiPrakashan,1st edition,2011.
2. S. Philominathan, Advanced Practical Physics & Electronic experiments, PHI, 2nd edition, 1998.

SEMESTER II: CORE BASED ELECTIVE – II
COMPUTATIONAL METHODS FOR PHYSICS

Course Code	**: 14PPH2CE2**	**Max.Marks**	**: 100**
Hours / Week	**: 6**	**Internal Marks**	**: 40**
Credit	**: 5**	**External Marks**	**: 60**

Objectives:

- To understand the numerical computations for algebraic, transcendental and linear simultaneous equations.
- To understand the concept of linear interpolation and curve fitting.
- To understand the numerical differentiation and integration.

UNIT –I Roots of Algebraic and Transcendental Equations 18 hours

Roots of a general polynomial equation- Roots of a quadratic equation- Newton's Relations- Descartes Rules-Transcendental Equations-The False Position Method – Newton – Raphson method- C

programs for finding the roots of a simple quadratic equation and for polynomial equations by using False Position and Newton – Raphson methods

UNIT - II Numerical Solution of Linear Simultaneous Equations 18 hours

Need and scope of Simultaneous Linear Equations- Existence of Solutions- Solution by Elimination - Basic Gauss Elimination Method - Gauss Elimination with Pivoting-**#**Applications to Electrical Networks**#**- C Programs for implementing Basic Gauss Elimination Method and Gauss Elimination Method with pivoting

UNIT - III Curve Fitting: Interpolation and Regression 18 hours

Interpolation-Polynomial Forms -Linear interpolation – Lagrange's interpolation Formula-Newton Interpolation Polynomial-Divided Difference Table - C programs for implementing Lagrange's interpolation formula and Newton's interpolation formula

Curve Fitting of Linear Equations-Linear Least Squares Regression Method- Fitting of Transcedental Equations-C-Programs for implementing these.

Unit – IV Numerical differentiation and integration 18 hours

Numerical Differentiation: Newton's forward, central and backward difference Coeffecients-Higher Order Derivatives – Differentiating Tabulated Functions-**#**Difference Tables**#**

Numerical integration: the trapezoidal rule, Simpson's 1/3 rule –C program to evaluate integrals using trapezoidal and Simpson's 1/3 rules.

UNIT –V Numerical Solution of ODE's: Initial and Boundary Value Problems 18 hours

Order and Degree of ODE's- Euler's Method - RungeKutte Fourth Order Method-Systems of Differential Equation -C Program to implement RK4 Method for a First Order differential Equation.

Boundary value problems- Shooting Method-Conversion of Boundary Value Problems to Eigen Value Problems-Polynomial Method

#.....#Self study portion

Text books

T.B 1 Suresh Chandra, Computer Applications in C, Narosa, Publishing House,NewDelhi, Second Edition, 2006

T.B 2 E. Balagurusamy, Numerical methods, TataMcGraw Hill, New Delhi, Second edition, 1999.

UNIT I	**Chapter 4**	**Sections 4.1 - 4.9**	**T.B 1**
UNIT II	**Chapter 7**	**Sections 7.1 - 7.5**	**T.B 2**
UNIT III	**Chapter 9 & 10**	**Sections 9.1 - 10.3**	**T.B 2**
UNIT IV	**Chapter 11 &12**	**Sections 11.1 - 12.4**	**T.B 2**
UNIT V	**Chapter 13 & 14**	**Sections 13.1 - 14.5**	**T.B 2**

Book for reference:

K.R. Venugopal and S.R. Prasad, Mastering C, Tata Mc-GrawHill,NewDelhi,Thirdedition,2007

SEMESTER II: CORE BASED ELECTIVE – II
NANOSCIENCE AND TECHNOLOGY

Course Code : 14PPH2CE2 **Max.Marks : 100**
Hours / Week : 6 **Internal Marks : 40**
Credit : 5 **External Marks : 60**

Objectives:

- To learn the nano technology and nano materials
- To study the application of nano materials in medicine
- To understand Evaluation techniques and Green technology

UNIT-I Nano Technology and Nano materials 18 hours

Nanotechnology – Basics and Basis – Four generations of Nano-technology development – Thermal, optical, electrical and magnetic properties of nanomaterials- Classification of Nano materials –

Techniques of preparation – Bottom up methodology (Sol-Gel technique) – Top down methodology – Fullerenes – #Properties of fullerenes#.

UNIT - II Carbon Nanotube 18 hours

Introduction – types of Carbon Nanotubes – Single walled (SWNT) Nanotubes – Multi walled (MWNT) Nanotubes – Properties – Kinetic property – Electrical property – Thermal property – defects of Nanotubes – One dimentional transport – toxicity – Synthesis – Arc discharge – Laser ablation – Chemical Vapour deposition – Applications of Carbon Nanotubes in Chemical, Mechanical and current fields.

UNIT - III Nanophysics 18 hours

Quantum dot – Quantum confinement in semi conductors – #Optical properties# – Fabrication – Computing field – Photo voltaic and Light emitting devices – quantum wire – quantum well – Fabrication – Quantum Point – Applications – Nanocrystals – Nanocrystal solar cell – Moore's law and nanocircuitary – Nano wire.

UNIT – IV Nanomedicine and Nanobiology 18 hours

Basic concepts and applications – Drug delivery – Cancer diagnosis and therapy – Neuro – electronic devices – nanobiotechnology devices – nano particles – nanoshell –biosensors –principle of detection – optical and electro chemical biosensors – applications of nano bio sensors – nano-DNA technology – Applications.

UNIT – V Evaluation techniques and Green technology 18 hours

Scanning Probe Microscope - types -Tunnelling Electron Microscope (TEM) – Instrumentation - Atomic Force Microscopy(AFM) –Scanning Tunneling Microscopy (STM) -Green Nano technology - Methodology – Health risk and environmental issues – Positive, negative aspects and implications of Nano Sciences for Society.

#.....#Self study portion

Text book

S. Shanmugam ,Nano Technology,MJP Publishers,First edition, 2011

UNIT I	**Chapter 1 & 2**	**Sections 1.1 – 2.7**
UNIT II	**Chapter 2**	**Sections 2.8 – 2.12**
UNIT III	**Chapter 3 & 4**	**Sections 3.1 – 4.10**
UNIT IV	**Chapter 7**	**Sections 7.1 – 7.8**
UNIT V	**Chapter 8 & 9**	**Sections 8.1 – 9.17**

Book for reference:

KK.Chattobpadhyay,Introduction to Nano Science and Technology, PHI, New Delhi, 2011.

SEMESTER III: CORE – IX
ATOMIC AND MOLECULARSPECTROSCOPY

Course Code : 14PPH3C9 **Max.Marks : 100**
Hours / Week : 6 **Internal Marks : 40**
Credit : 5 **External Marks : 60**

Objectives:

- To understand the principles of Vibrational, Rotational, Electronic, mass and Resonance Spectroscopies.
- Tostudy the component of the spectrometer and to determination molecular structure.

UNIT – I Vibrational and Rotational Spectroscopy – I 18 hours

Classification of molecules – Rigid rotor – non-rigid rotor – effect of isotopic substitution – intensity of rotational lines – linear poly atomic molecules : Symmetric & Asymmetric type – stark

effect – micro wave spectrometer – **#**applications of microwave spectroscopy**#** – IR spectroscopy – vibrating diatomic molecule – diatomic vibrating rotator – FTIR spectrometer.

UNIT - II Vibrational and Rotational Spectroscopy – II 18 hours

Raman Effect – rotational Raman spectra – vibrational Raman spectra – vibrational-rotational Raman spectra – Resonance Raman spectroscopy – Nonlinear Raman effects – hyper Raman effect and its classical treatment – stimulated Raman scattering – inverse Raman scattering – Coherent Anti-stokes Raman Scattering (CARS) – Raman spectrometer.

UNIT - III Electronic Spectroscopy 18 hours

Electronic spectroscopy of atom: Electronic wave functions - shapes and energies of atomic orbitals-orbital angular momentum-fine structure of hydrogen atom.

Electronic spectroscopy of molecules: Electronic spectra of diatomic molecules-Frank-Condon principle – dissociation energy and dissociation product – Rotational fine structure of electronic vibration transition.

UNIT – IV Mass Spectroscopy 18 hours

Introduction – theory – components of mass spectrometer – spark source ionization – Chemical ionization – ion separator – double focusing – ion collectors – recordings of mass spectrogram – resolution of mass spectrometer – applications – molecular mass determination – latent heat of vaporization of liquids.

UNIT – V Resonance Spectroscopy 18 hours

NMR: Basic principles – chemical Shift – Relaxation process – Instrumentation: Fourier transform method – NMR Imaging.

ESR: Basic Principles – Nuclear interaction and hyperfine structure –'g' characteristics - ESR Spectrometer – **#**Applications**#**

#.....#Self study portion

Text books

T.B 1 H.Kaur, Spectroscopy ,PragathiPrakasan, Eighth edition,2013

T.B 2 Colin N. Banwell and Elaine M. Mccash Fundamentals of Molecular Spectroscopy, McGraw Hill Publishing Co. London, Fourth edition, 2000

T.B 3 GurdeepChatwal& Sham Anand, Spectroscopy, HPH Publishers, Fifth edition 2013

T.B 4 Gupta Kumar Sharma, Elements of Spectroscopy (Atomic, Molecular, Laser Physics), PragathiPrakasan, 23rd Edition, 2013

UNIT I	**Chapter 4**	**Sections 4.1 - 4.7**	**T.B 1**
UNIT II	**Chapter 6 & 21**	**Sections 6.1 -6.12& 21.1 - 21.7**	**T.B 1**
UNIT III	**Chapter 5& 6**	**Sections 5.1 - 6.3**	**T.B 2**
UNIT IV	**Chapter 11**	**Sections 11.3 - 11.11**	**T.B 3**
UNIT V	**Chapter 7**	**Sections 7.4 - 7.13**	**T.B 4**

Book for reference:

G. Aruldhas, Molecular Structure and Spectroscopy, PHI Publishers,2nd edition,2011

SEMESTER III: CORE – X
QUANTUM MECHANICS

Course Code : 14PPH3C10 | **Max.Marks : 100**
Hours / Week : 6 | **Internal Marks : 40**
Credit : 5 | **External Marks : 60**

Objectives:

- To understand the concepts and Formalism of Quantum Mechanics
- To practice Eigen value problems and matrix formulation
- To learn approximation methods to study perturbation theory
- To study the concepts of Angular Momentum and Spin States and Relativistic Wave Equations.

UNIT – I Concepts and Formalism of Quantum Mechanics 18 hours

Time dependent Schrödinger equation- Physical Interpretation of Wave function ψ:

Normalization andProbability Interpretation -Conservation of Probability: #Equation of Continuity# – ExpectationValues: Ehrenfest's Theorem -Admissibility conditions on wave functions-Stationary states: Time independent Schrödinger wave equation.

UNIT - II Exactly Soluble Eigen Value Problems and Matrix Formulation 18 hours

Angular Momentum Operators [L^2&L_z] – Angular Momentum Commutation Relations – Eigen valuesand Eigen functions of Angular Momentum Operators-One Dimensional Linear Harmonic OscillatorReduction of a Two Body Hamiltonian-Hydrogen AtomHilbert space - Dirac's Notation - Hermitian Operators -Matrix Representation of Wave functions and Operators- Unitary Transformations- Matrix theory of a linear harmonic oscillator - Equations of Motions - Schroedinger, Heisenberg and Interaction Pictures

UNIT - III Approximation Methods 18 hours

Stationary State Perturbation theory:non-degenerate and degenerate cases- #Applications#: Stark Effect in the ground state and first excited state of Hydrogen atom

Variation Method: The Variational Principle – Rayleigh-Ritz Method –Ground State of Helium Atom

Time Dependent Perturbation Theory: First Order Perturbation–Harmonic Perturbations-Transition to Continuum States - Fermi's Golden Rule

UNIT – IV Angular Momentum and Spin States 18 hours

Raising & lowering operators – Eigen values of J^2 and J_Z –Angular Momentum Matrices – Addition of Angular Momenta: Clebsch–Gordan coefficients – Recursion relation for C.G. coefficients – Computation of C.G. matrix for simple cases [(j_1 =½, j_2 = 1/2),(j_1 = ½,j_2 =1)]

Spin angular momentum- spin ½ states -Pauli's spin matrices and their properties- Particle Exchange Operation - symmetric and antisymmetric wave functions- Construction of symmetric and antisymmetric wave functions from unsymmetrized wave functions –Pauli's Exclusion Principle – Wave function for a particle including spin

UNIT – V Relativistic Wave Equations 18 hours

Klein-Gordon Equation for free particle- Merits and its Demerits-Dirac's Relativistic Equation for a free particle-Dirac's Matrices-Covariant form of Dirac's Equation-Probability Densities for

charge and current-Plane wave solutions of the Dirac's Equation- Negative Energy States -Dirac's Equation for a particle in a Central Potential– Spin of a Dirac Particle

#.....#Self study portion

Text books

T.B 1 P.M. Mathews and K. Venkatesan, A Text Book of Quantum Mechanics, Tata McGraw Hill, New Delhi,Second edition, 2005.

T.B 2 G. Aruldhas, Quantum Mechanics, PHI, New Delhi,Second Edition, 2009

UNIT I	**Chapter 2**	**Sections 2.1 - 2.9**	**T.B 1**
UNIT II	**Chapter 2 ,4& 6**	**Sections 2.10, 2.11, 4.1 - 4.17 & 6.17**	**T.B 1**
UNIT III	**Chapter 5**	**Sections 5.1 - 5.4**	**T.B 1**
UNIT IV	**Chapter 8 & 13**	**Sections 8.4 - 8.9 & 13.1 - 13.3**	**T.B 2**
UNIT V	**Chapter 15**	**Sections 15.1 - 15.10**	**T.B 2**

Book for reference:

N. Devanathan, Quantum Mechanics, Narosa Publishing House, Second edition,2005.

SEMESTER III: CORE – XI
STATISTICAL MECHANICS

Course Code : 14PPH3C11 | **Max.Marks : 100**
Hours / Week : 6 | **Internal Marks : 40**
Credit : 5 | **External Marks : 60**

Objectives:

- To understand the classical and quantum statistics for energy distributions
- To study the kinetic theory of gases and principles of entropy.

UNIT – I Classical Statistics **18 hours**

Phase space – **#**Ensembles**#** – Liouville's theorem – statistical equilibrium – partition function – properties – relation between partition function and thermodynamic quantities – thermo dynamic probability – principle of equipartition energy – Boltzmann entropy relation.

UNIT - II Kinetic theory 18 hours

Binary collisions – Boltzmann transport equation – Boltzmann's H-theorem and its analysis – transport phenomenon – mean free path – zero order approximation – viscosity of a gas – Navier-Stoke's equation – Application to incompressible liquids.

UNIT - III Entropy and Thermodynamics 18 hours

Entropy – Principle of increase of entropy – entropy and disorderness – entropy and probability – Gibb's paradox – resolution of paradox – Sackur-tetrode equation – thermodynamic potentials and reciprocity relations – equilibrium conditions (thermal Mechanical and Concentration).

UNIT – IV Quantum statistics 18 hours

Ideal Bose systems – Photon gas – Thermal properties of Bose-Einstein gas – B-E condensation – B-E degeneracy – Mean energy of Fermions – Electron gas in metals–Thermionic emission work function – **#**white dwarfs**#**.

UNIT – V Advanced Statistical Mechanics 18 hours

Super fluids – Liquid Helium – λ-transition – Tisza's two fluid model – Pauli's theory of para magnetism – general formulation of Ising model – One dimensional Ising model – Critical phenomenon – order parameter.

#.....#Self study portion

Text books

T.B 1 Gupta and Kumar, Statistical Mechanics, 22nd Edition , PragathPrakasan Publication, 2011.

T.B 2 B.K. Agarwal and Melvin Eigner, Statistical Mechanics,New age Publication, Second Edition,2013.

T.B 3 Kerson Huang, Statistical Mechanics, Wiley India Publication, Second Edition,2013.

UNIT I	**Chapter 1 & 2**	**Sections 1.1 - 2.17**	**T.B 1**
UNIT II	**Chapter 3 - 5**	**Sections 3.2 - 5.9**	**T.B 3**
UNIT III	**Chapter 3**	**Sections 3.1 - 3.6**	**T.B 2**
UNIT IV	**Chapter 8 & 9**	**Sections 8.1- 9.6**	**T.B 1**
UNIT V	**Chapter 13 - 16**	**Sections 13.2 - 16.2**	**T.B 3**

Book for reference:

R.K. Pathira& Paul D. Beale, Statistical Mechanics, Elsevier Academic press,Second edition, 2011.

SEMESTER III: CORE – XII

DIGITAL ELECTRONICS - PRACTICAL

Course Code : 14PPH3C12P1
Hours / Week : 3
Credit : 3

Max.Marks : 50
Internal Marks : 20
External Marks : 30

Objectives:

- To realize the digital circuits
- To practice the circuit constructions

1. IC Regulated Dual Power Supply
2. Verification of De Morgan's theorem and simplification of Boolean expressions using K-Map.
3. Adders and Subtractors using Logic Gates.

4. Counters & Displays.

   [0 – 9 counter using IC 7490, 7 segment display using decoder driver 7447]
5. Flip flops – RS, JK & D flip flops.
6. Shift register
7. Comparators (1-bit and 2-bit)
8. Multiplexer and Demultiplexer.

Books for reference:

1. S.P.Singh, Advanced Practical Physics, A PragathiPrakashan, 1st edition, 2011.
2. C.C. Ouseph, U.J. Rao & V. Vijayendran, Practicalphysics and electronics, S. Viswanathan, Pvt,Ltd, 2007.

SEMESTER III: CORE – XII

NUMERICAL PROGRAMMING IN PHYSICS - PRACTICAL

Course Code	**: 14PPH3C12P2**	**Max.Marks**	**: 50**
Hours / Week	**: 3**	**Internal Marks**	**: 20**
Credit	**: 2**	**External Marks**	**: 30**

Objective:

- To practice the numerical computation for solving scientific application problems using 'C' programs.

1. False position method: Roots of a Quadratic equation
2. Newton's Raphson's method: Roots of a polynomial equation.
3. Gauss elimination Method: Application to electrical network.
4. Linear Least Squares Fitting: Determination of the charge of an electron.

5. Eigen Values and Eigen vectors of a matrix
6. Determinant of a matrix
7. Evaluation of statistical parameters: Mean deviation, Standard deviation
8. Random number generation – Determination of the value of pi

Books for reference:

1. Suresh Chandra, Computer Applications in C, Narosa, Publishing House, New Delhi, Second Edition, 2006
2. E. Balagurusamy, Numerical methods, TataMcGraw Hill, New Delhi, Second edition, 1999.

SEMESTER III: CORE BASED ELECTIVE– III
SPECIAL ELECTRONICS

Course Code	**: 14PPH3CE3**	**Max.Marks**	**: 100**
Hours / Week	**: 6**	**Internal Marks**	**: 40**
Credit	**: 5**	**External Marks**	**: 60**

Objectives:

- To understand the hardware components and software programming instructions of INTEL 8085, 8086 microprocessors and 8051 microcontroller.
- To understand the concept of interfacing and peripheral devices.

UNIT – I Intel 8085 Microprocessor: Architecture, Instructions and Programming 18 hours

Intel 8085 - Architecture – Pin diagram – **#**Instruction word size**#** – Instruction Cycle – Fetch and Execute operations - Timing diagram – Op-code Fetch – Memory read and write – I/O read and write.Instruction set – Addressing modes – Intel 8085 instructions – Assembly language program for

addition, subtraction, Multiplication and division–sum of a series of 8-bit numbers – Arrange an array of data in ascending and descending order – block transfer.

UNIT - II Interfacing and Peripheral Devices 18 hours

Address space partitioning – Memory and I/O Interfacing – Data Transfer schemes – DMA Data Transfer schemes – Synchronous data transfer - Asynchronous data transfer – **#**Interrupt driven data transfer**#** – Interrupts of Intel 8085.Programmable Peripheral Interface (8255A) – Programmable Interrupt Controller(8259) – Programmable DMA controller(8257) – Functional block diagram and modes of operation.

UNIT - III Intel 8086 Microprocessor 18 hours

Introduction - pin functions of 8086 – clock generator – 8086 architecture –timing diagram – interrupts. Addressing modes – instructions – data transfer, arithmetic, logical, comparative, shift, rotate, conditional and unconditional branching – push – pop – string data.

Programs: Addition, Subtraction & Factorial.

UNIT – IV 8051 Microcontroller 18 hours

8051 block diagram – program counter and data pointer – A and B CPU registers – PSW – Internal RAM – the stack and stack pointer – special function register – internal ROM – I/O ports – counters and timers – serial data I/O – Interrupts – Timer, Serial port, External and Reset.

UNIT – V Assembly Language Instruction and Programming 18 hours

Moving data and applications – address of modes – external data moves – code memory read only data moves – Push and POP – data exchange – logical operations – byte and bit level operations – arithmetic operations – Jump and call instructions – Jumps, Calls and return operations -Interfacing Intelligent LCD – D/A and A/D convertors.

#.....#Self study portion

Text books

T.B 1 B.Ram, Fundamentals of Microprocessors and Microcomputers, DhanpatRai Publication Ltd, Seventh edition, 2011

T.B 2 V.Vijayendran, Fundamental of Microprocessor 8086, SV Printers &Publishers,LTD, Fifth edition, 2013.

T.B 3 Kenneth Ayala, The 8051 Microcontroller, Delmar Learning, First edition, 2005.

UNIT I	**Chapter 1 & 2**	**Sections 1.1 - 2.17**	**T.B 1**
UNIT II	**Chapter 3 - 5**	**Sections 3.2 - 5.9**	**T.B 3**
UNIT III	**Chapter 3**	**Sections 3.1 - 3.6**	**T.B 2**
UNIT IV	**Chapter 8 & 9**	**Sections 8.1 - 9.6**	**T.B 1**
UNIT V	**Chapter 13 - 16**	**Sections 13.2 - 16.2**	**T.B 3**

Book for reference:

R.K. Pathira& Paul D. Beale, Statistical Mechanics, Elsevier Academic press,Second edition, 2011.

SEMESTER III: CORE BASED ELECTIVE– III
ELECTRONIC INSTRUMENTATION

Course Code : 14PPH3CE3 **Max.Marks : 100**
Hours / Week : 6 **Internal Marks : 40**
Credit : 5 **External Marks : 60**

Objectives:

- To understand the principles and operations of analog and digital instruments
- To study Signal Generators and Waveform analysis
- To learn the principle of transducers and their classifications

UNIT – I Analog Instruments **18 hours**

DC Instruments: PMMC Movement – DC ammeter – Multirange ammeters – **#**DC voltmeter**#** – Multirange DC voltmeter – Sensitivity of Voltmeter.

AC Instruments: AC Voltmeter using half-wave rectifier – Multirange AC voltmeter – Transistor voltmeter (TVM) – Electronic voltmeter (Solid State m/V)

UNIT - II Digital Instruments 18 hours

Digital Voltmeters: Ramp type digital voltmeter –Dual slop type digital voltmeter –Digital voltmeter –digital multimeter.

Digital measurements:#Digital frequency meter**#**– Digital measurement of time – Universal counter (Timer).

UNIT - III Signal Generators 18 hours

Basic Signal generators: Standard signal generator – Modern laboratory signal generator – AF sine and square wave generators.

Special signal generators: Function generator – Pulse and square generator – sweep generators – pattern generator.

UNIT – IV Waveform analysis 18 hours

Basic wave analyser – Frequency selective wave analysers – Heterodyne wave analysers – Spectrum analysers – Harmonic distortion analysers – Harmonic distortion analysers using a resonance bridge, Wien bridge and bridged-T method.

UNIT – V Transducers 18 hours

Classification of transducers – Potentiometer – unbounded strain gage – Bonded strain gage foil type strain gage – Linear variable differential transducer (LVDT) – Rotational variable differential transducer (RVDT)

#.....#Self study portion

Text book:

H.S.Kalsi, Electronic Instrumentation , Learning Materials centre, New Delhi, Second edition, 2002.

UNIT I	**Chapter 2**	**Sections 2.4 – 2.41**
UNIT II	**Chapter 3**	**Sections 3.3 – 3.27**
UNIT III	**Chapter 5**	**Sections 5.3 – 5.22**
UNIT IV	**Chapter 6**	**Sections 6.3 – 6.18**
UNIT V	**Chapter 8**	**Sections 8.42 – 8.51**

Book for reference:

P.S.Manoharan, Microprocessors & Microcontrollers, Charulatha Publications, Second edition,2011

SEMESTER III: EXTRA CREDIT – I
NONLINEAR ELECTRONICS

Course Code : 14PPH3EC1 | **Max.Marks : 100**
Hours / Week : -- | **Internal Marks: --**
Credit : 5 | **External Marks: 100**

Objectives:

- To understand the concept of nonlinearity its mathematical implications in oscillators.
- To study the characterisation of nonlinear oscillations
- To understand the concepts of Chaos in nonlinear electronics circuits

UNIT- I: Linear and Nonlinear Oscillators

Nonlinearity - Mathematical Implications of Nonlinearity-Linear Superposition Principle-Effects of Nonlinearity-Linear Oscillators and Predictability: Free Oscillations, Damped Oscillations,

Damped and Forced Oscillations-Nonlinear Oscillators and Bifurcations: Free Oscillations, Damped Oscillations, Forced Oscillations: Primary Resonance and Jump Phenomenon (Hysteresis), Secondary Resonances (Subharmonic and Superharmonic), Bifurcations.

UNIT- II: Qualitative Features of Dynamical Systems

Autonomous and Nonautonomous Systems-Equilibrium Points of Dynamical Systems-Phase Space/Phase Plane and Phase Trajectories: Stability, Attractors and Repellers-Classification of Equilibrium Points of a Two-Dimensional Dynamical System: General Criteria for Stability - Limit Cycle Motion- Periodic Attractor- Poincar'e-Bendixson Theorem - Lorenz System - More Complicated Attractors: Torus, Quasiperiodic Attractor, Poincar'e-Map, Chaotic Attractor.

UNIT- III: Bifurcations and Onset of Chaos in Dissipative Systems

Some Simple Bifurcations: Saddle-Node Bifurcation, The Pitchfork Bifurcation, Transcritical Bifurcation, Hopf Bifurcation - Discrete Dynamical Systems-The Logistic Map: Equilibrium Points and their Stability, Periodic Solutions or Cycles, Period Doubling Phenomenon, Onset of Chaos: Sensitive Dependence on Initial Conditions â€“ Lyapunov Exponent, Bifurcation Diagram-Other Routes to Chaos: Quasiperiodic Route, Intermittency Route, Type-I Intermittency, Standard Bifurcations in Maps.

UNIT- IV: Chaos in Dissipative Nonlinear Oscillators and Criteria for Chaos

Bifurcation Scenario in Duffing Oscillator: Period Doubling Route to Chaos, Intermittency Transition, Quasiperiodic Route to Chaos, Strange Nonchaotic Attractors (SNAs), Lorenz Equations: Period Doubling Bifurcations and Chaos - Necessary Conditions for Occurrence of Chaos: Continuous Time Dynamical Systems (Differential Equations), Discrete Time Systems(Maps)

UNIT- V: Chaos in Nonlinear Electronic Circuits

Linear and Nonlinear Circuit Elements - Linear Circuits: The Resonant RLC Circuit - Nonlinear Circuits –Chua's Diode - A Simple Practical Implementation of Chua's Diode -Chua's Oscillator - Bifurcations and Chaos in Chua's Oscillator –Murali-Lakshmanan-Chua (MLC) Circuit: Experimental

Realization, Stability Analysis, Explicit Analytical Solutions, Experimental and Numerical Studies - Analog Circuit Simulation of a Duffing Oscillator- Nonlinear Circuits as Dynamical Systems.

Text book:

M. Lakshmanan, S.Rajasekar, Nonlinear Dynamics (Integrability, Chaos and Patterns), Springer, 2002.

UNIT I	**Chapter 1 &2**	**Sections 1.1 – 2.3**
UNIT II & III	**Chapter 3& 4**	**Sections 3.1 – 4.4.4**
UNIT IV	**Chapter5**	**Sections 5.1 – 5.4.1**
UNIT V	**Chapter6**	**Sections 6.1 – 6.5**

Book for reference:

Govind P. Agarwal, Applications of Nonlinear fibre optics, Academic Press, Newyork, First edition, 1989.

SEMESTER IV: CORE – XIII
SOLID STATE PHYSICS

Course Code : 14PPH4C13 **Max.Marks : 100**
Hours / Week : 6 **Internal Marks : 40**
Credit : 5 **External Marks : 60**

Objectives:

- To study the structure of crystalline solids
- To study the carrier movement, lattice vibration and thermal property in solids
- To understand the concepts of Free Electron and Band Theory of Solids
- To study the dielectric and super conductivity materials

UNIT-I **Crystal Physics** **18 hours**

Crystals-Crystal lattice and translation vectors -Types of lattices (2D & 3D)-Point group - Space

groups- Lattice direction and planes- Simple crystal structures-Close packed and loose packed structures- Structure of Diamond, Zinc Blende and Sodium chloride- X-ray diffraction-X-ray diffraction methods (Laue's method, Power crystal method)-Reciprocal lattice - **#**Properties**#**- Imperfections in crystals- Point defects - line defects.

UNIT-II Semiconductors, Lattice Vibrations and Thermal Property 18 hours

Intrinsic and Extrinsic semiconductors-General study of carrier movement- Fermi level and conductivity –Lattice vibrations-One dimensional Monotomic lattice-One dimensional diatomic lattice-Phonons- Phonon momentum- Lattice heat capacity- Classical theory (Dulong and Petit Law) - Einstein theory- Debye's model-Density modes.

UNIT-III Free Electron Theory and Band Theory of Solids 18 hours

Drude - Lorentz's classical theory of free electron gas – Relation between thermal and electrical conductivity (Wiedemann-Franz Law) –Free electron Gas in a 1-D - Free electron Gas in a 3-D-Application of free electron gas model – Bloch theorem –Kronig-Penny model – **#**velocity and effective mass of electron**#**.

UNIT-IV Dielectrics and Magnetism in Solids 18 hours

Polarization and Susceptibility – Local field-Dielectric constant and Polarizability (Clausius-Mosotti Equation) - Sources of Polarizability - Ferro electricity - Piezo electricity.

Classical and Quantum theory of Dia and Para magnetism- -Weiss theory of ferromagnetism-Hund rules-Concepts of Domains –Antiferromagnetism-ferrimagnetism

UNIT-V Superconductivity 18 hours

Introduction –The Meissner effect – Soft and hard superconductors –Thermo dynamical and optical properties – Type -I and Type-II superconductors- London equations – BCS theory- Quantum tunneling-Josephson tunneling- Theory of DC Josephson effect– Theory of AC Josephson effect- High T_c super conductors – SQUIDS – critical fields – critical currents –Magnetic levitations.

#.....#Self study portion

Text book:

S. O. Pillai,Solid State Physics , New Age International (P) Ltd, Revised 6th Edition, 2008.

UNIT I Chapter 4

UNIT II Chapter 5,7 &10

UNIT III Chapter 6

UNIT IV Chapter 9

UNIT V Chapter 8

Books for reference:

1. C.Kittel, Introduction to Solid State Physics,Wiley Publication,6th Edition, 2008.
2. Gupta, Kumar, Sharma,Solid State Physics, S. Chand & Company Ltd, 4th Edition, 2004.
3. R.K. Puri and V.K. Babbar, Solid State Physics,S. Chand & Company Ltd,5th Edition, 2010 .

SEMESTER IV: CORE – XIV

MICROPROCESSOR AND MICROCONTROLLER - PRACTICAL

Course Code	**: 14PPH4C14P1**	**Max.Marks**	**: 50**
Hours / Week	**: 3**	**Internal Marks**	**: 20**
Credit	**: 3**	**External Marks**	**: 30**

Objective:

- To practice Intel 8085 and Intel 8051 assembly language programs with interfacing circuits

Microprocessor Experiments using Intel 8085

1. Conversion from Decimal to Hexadecimal and vice versa.
2. Interfacing ADC
3. Wave form generation using DAC 0800
4. Interfacing Hex key board

Microcontroller Experiments using Intel 8051

1. Basic Arithmetic Operations
2. Interfacing seven segment display

3. Stepper Motor control
4. Traffic light control

Book for reference:

B.Ram, Fundamentals of Microprocessors and Microcomputers, DhanpatRai Publication, Ltd, 7th edition, 2011.

SEMESTER IV: CORE – XIV

NUMERICAL SIMULATIONS IN PHYSICS - PRACTICAL

Course Code	**: 14PPH4C14P2**	**Max.Marks**	**: 50**
Hours / Week	**: 3**	**Internal Marks**	**: 20**
Credit	**: 2**	**External Marks**	**: 30**

Objective:

- To practice numerical simulations of Physics principles by scientific programming using C language.

1. Plotting of Linear Harmonic Oscillator wave functions.
2. Numerical simulation of Beats.
3. Lagrange's Interpolation: Determination of nuclear energies.
4. Simulation of Brownian motion
5. Simulation of Radioactive decay.
6. Trapezoidal Rule: Simulation of free falling motion of a body.
7. Simpson's Rule: Motion of a body in a central potential.
8. RK-IV method: Electromagnetic Oscillations in an LCR circuit.

Books for reference:

1. Suresh Chandra, Computer Applications in C, Narosa, Publishing House, New Delhi, Second Edition, 2006
2. E. Balagurusamy, Numerical methods, TataMcGraw Hill, New Delhi, Second edition, 1999.

SEMESTER IV: EXTRA CREDIT – II
NON – CONVENTIONAL ENERGY SOURCES

Course Code : 14PPH4EC2 | **Max.Marks : 100**
Hours / Week : -- | **Internal Marks: --**
Credit : 5 | **External Marks: 100**

Objective:

- To understand the concepts of nonconventional energies resources and their applications

UNIT - I Solar Energy

Introduction – Solar constant – Solar radiation at the earth's surface – Solar radiation measurements – Flat-Plate collectors – solar Air heaters – Concentrating collectors – Selective coatings – solar water heater – Solar Electric power generation – Solar cooker.

UNIT - II Wind Energy & Biomass

Introduction – Principles of wind energy conversion – Power in the Wind – Basic component of a Wind Energy (WECS) Conversion systems – Classification of WECS – Advantages and Disadvantages of WECS.

Bio-Mass – Photosynthesis – Bio-gas generation – Types of Bio-gas plants – Bio-gas from plant wastes

Fuel properties of Bio-gas – Advantages and disadvantages.

UNIT - III Geothermal & Ocean Energies

Introduction – Geothermal sources – Hydrothermal resources – Hot dry Rock resources – Magma resources – Applications of geothermal energy.

OTEC – Open cycle OTEC system – Heat exchangers – Basic principle of Tidal power – merits and demerits of wave energy.

UNIT – IV Chemical Energy Sources

Fuel cells – Classification – Design and principle of operation – application of fuel cells – Hydrogen fuel cells – Types – Batteries – Different types of Battery arrangement – Lead-Acid, Nickol-Iron, Nickel-Cadmium batteries – High temperature batteries – Advantages of Batteries for Bulk energy storage.

UNIT – V Hydrogen and Nuclear energy source

Hydrogen energy – Production of hydrogen – Hydrogen storage – advantages of hydrogen fuel engines. Nuclear fission, fusion – Basic Nuclear fusion reaction – Thermo nuclear function reactors.

Text book:

G.D. Rai, Solar energy utilisation, khanna Publishers,5th edition, 2012.

UNIT I	**Chapter 3, 5, 6, 7, 16**
UNIT II & III	**Chapter 18**
UNIT IV	**Chapter 9**
UNIT V	**Chapter 16**

Books for reference :

1. B. H. Khan, Non-ConventionalEnergyResources, Tata McGraw Hill Education Private Limited, Second Edition, 2013.

2. S.P. Sukhatme& J.K. Nayak ,SolarEnergy ,Tata McGraw Hill Education Private Limited, Third Edition, 2010.