MASTER OF SCIENCE
IN
PHYSICS

SYLLABUS 2018-19

(Outcome Based Education)

Dr. N.G.P. ARTS AND SCIENCE COLLEGE
(An Autonomous Institution, Affiliated to Bharathiar University, Coimbatore)
Approved by Government of Tamil Nadu and Accredited by NAAC with 'A' Grade (2nd Cycle)
Dr. N.G.P.- Kalapatti Road, Coimbatore-641048, Tamil Nadu, India
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MASTER OF SCIENCE-PHYSICS

REGULATIONS

ELIGIBILITY

A pass in the course of B.Sc Degree Examination with Physics as Major and Mathematics and Chemistry as Ancillary subjects., or an examination accepted as equivalent there to accept by the academic council.

PROGRAM EDUCATIONAL OBJECTIVES

The curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

1. To produce graduates with advanced knowledge in Physics and requisite skills, in order to use their knowledge in Physics in a wide range of practical applications.
2. To develop creative thinking and the power of imagination to enable graduates work in research in academia and industry for broader applications.
3. To relate the training of Physics graduates to the employment opportunities within the country.
4. To promote societal values through Physics related activities.

SCHEME OF EXAMINATIONS

Course Code	Course	Hrs of Instruction	Exam Duration (Hrs)	Max Marks			Credit Points
				CA	CE	Total	
First Semester							
18PPY13A	Core-I Mathematical Physics	4	3	25	75	100	4
18PPY13B	Core-II Numerical Methods	4	3	25	75	100	4
18PPY13C	Core-III Solid State Physics	5	3	25	75	100	4
18PPY13D	Core-IV Classical Mechanics	5	3	25	75	100	4
18PPY13P	Core Practical-I General Experiments	4	4	20	30	50	2
18PPY13Q	Core Practical -II General Electronics Lab	4	4	20	30	50	2
	Elective I	4	3	25	75	100	4
		30				**600**	**24**
Second Semester							
18PPY23A	Core-V Applied Thermodynamics and Statistical Mechanics	4	3	25	75	100	4
18PPY23B	Core-VI Quantum Mechanics I	5	3	25	75	100	4
18PPY23C	Core-VII Applied Spectroscopy	5	3	25	75	100	4
18PPY23D	Core-VIII Nuclear And Particle Physics	4	3	25	75	100	4
18PPY23P	Core Practical -III General Experiments	4	4	20	30	50	2

18PPY23Q	Core Practical -IV Special Electronics Lab	4	4	20	30	50	2
	Elective II	4	3	25	75	100	4
		30				**600**	**24**
Third Semester							
18PPY33A	Core-IX Quantum Mechanics II	5	3	25	75	100	4
18PPY33B	Core-X Advanced Electronics	5	3	25	75	100	4
18PPY33C	Core-XI Electromagnetic Theory	4	3	25	75	100	4
18PPY33P	Core Practical -V Advanced General Experiments	4	4	20	30	50	2
18PPY33Q	Core Practical -VI Advanced Electronics Lab	4	4	20	30	50	2
18PPY33T*	Internship Programme	-	3	-	50	50	2
	Project work	4	-	-	-	-	-
	Elective III	4	3	25	75	100	4
		30				**550**	**22**
Fourth Semester							
18PPY43A	Core-XII Microprocessor and its Applications	5	3	20	55	75	3
18PPY43B	Core-XIII Nanotechnology	5	3	20	55	75	3
18PPY43P	Core Practical -VII Microprocessor Lab	4	4	20	30	50	2
18PPY43V	Project work and Via-Voce	11	3	80	120	200	8
	Elective IV	5	3	25	75	100	4
		30				**500**	**20**
	TOTAL					**2250**	**90**

*Students should undergo training for a period of not less than 15 days during third semester and report has to be submitted for Via Voce examination (External Evaluation)

ELECTIVE – I

(Student shall select any one of the following courses as Elective-I in First semester)

S.No	Course Code	Name of the Course
1.	18PPY1EA	Bio Medical Instrumentation
2.	18PPY1EB	Laser Physics and Fiber Optics

ELECTIVE – II

(Student shall select any one of the following courses as Elective-II in Second semester)

S.No	Course Code	Name of the Course
1.	18PPY2EA	Crystal Growth, Thin Film and Plasma Physics
2.	18PPY2EB	Fundamentals of Electrical Circuits

ELECTIVE - III

(Student shall select any one of the following courses as Elective-III in third semester)

S. No	Course Code	Name of the Course
1.	18PPY3EA	Digital Communication
2.	18PPY3EB	Astrophysics

ELECTIVE - IV

(Student shall select any one of the following courses as Elective-IV in fourth semester)

S. No	Course Code	Name of the Course
1.	18PPY4EA	Renewable Energy Sources
2.	18PPY4EB	Materials Science

Total Credit Distribution

Courses	Credits	Total		Credits	Cumulative Total
CORE- theory	3	2x75=	150	6	64
	4	11x100=	1200	44	
CORE- Practical	2	7x 50 =	350	14	
Elective	4	4 x 100	400	16	16
Project work	8	1X200	200	8	08
Internship programme	2	1x50 =	50	02	02
Total			**2250**	**90**	**90**

FOR PROGRAMME COMPLETION

Students have to complete the following

- Core papers in I, II, III, and IV semesters.
- Elective papers in I, II, III, and IV semesters.
- Core Practical in I, II, III, and IV semesters.
- Project and Via- Voce in IV semester

Earning Extra credits is not mandatory for program completion

Extra credits

S.No	Course	Credit	Total credits
1	Paper Publication with Impact factor/SCI Journal	1	1
2	Hindi/ for foreign language	1	1
3	Papers presented in national /International Seminar/ conference/Workshop	1	1
4	Self Study paper prescribed by the department	1	1
5	Representation-Academic/sports/Social Activities/Extra curricular/Co-curricular Activities at university/district/state/national/international	1	1
	Total	5	**5**

Rules:

The students can earn extra credits only if they complete the above during the course period (I to III sem) and based on the following criteria. Proof of Completion must be submitted in the office of the Controller of Examinations before the commencement of the IV Semester.

1. Publication with Impact factor/SCI indexed journal by a student and co-authored by staff member will be given one credit extra.

2. Student who have not studied Hindi/other foreign language upto X std/XII std and taken Non –Hindi language under part I during her or his UG degree

shall take Hindi/ French/ Other foreign Language to earn one credit extra. The certificate (Hindi) must be obtained from **Dakshina Bharat Hindi Prachar Sabha**

3. Award winners in paper presentation in sponsored international/seminar/conference/participation in short term workshop will be given one credit extra.

4. Students can earn one credit if they complete any one of the self study paper offered by the concerned department

Self study paper offered by the PHYSICS Department

S. No.	Semester	Course Code	Course Title
1.	III SEM	18PPYSS1	**E**nvironmental Physics
2.		18PPYSS2	Electrical and Electronic Appliances

5. Award winners in /representation in sports at university/ district/state/ national/international/ co-curricular/extra-curricular/social activities will be given one credit extra.

Programme Educational Outcomes

On the successful completion of the **M. Sc. Physics** programme, the following are the expected outcomes.

PO Number	PO Statement
PO1	Apply theoretical knowledge of principles and concepts of Physics to practical problems.
PO2	Develop skills in planning and carrying out advanced physics experiments.
PO3	Solve scientific problems by applying a combination of theory, numerical simulation, and experiments.
PO4	Relate critically to scientific models.
PO5	Examining specific phenomena theoretically and experimentally, to contribute to the generation of new scientific insights or to the innovation of new applications of physics research.

18PPY13A	**CORE- I** **MATHEMATICAL PHYSICS**	SEMESTER I

Total Credits: 4

Hours per Week: 4

Preamble

To enable students to learn and relate basic mathematical concepts with Physics.

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concept of gradient, divergence, curl and apply laplacian operators in cylindrical, polar and spherical polar co-ordinates.	K2
CO2	Evaluation of definite integrals using Complex variables**.**	K3
CO3	Apply Laplace and Fourier Transform to linear differential equations.	K3
CO4	Define tensors, transformations law and Derive covariant and contravariant vectors	K4
CO5	Evaluate Special function, its properties and the expansion of function in terms of orthogonal polynomials**.**	K5

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	S	S	S	M
CO3	M	S	S	S	S
CO4	S	M	M	S	S
CO5	S	S	S	M	S

S-Strong; M-Medium; L-Low

18PPY13A	**CORE- I** **MATHEMATICAL PHYSICS**	SEMESTER I

Total Credits: 4

Hours per Week: 4

CONTENTS

UNIT 1 : Vector fields

Concept of gradient, divergence and curl – Gauss divergence theorem, Green's theorem and Stoke's theorem - Orthogonal curvilinear co-ordinate systems – Expression for gradient, divergence, curl and Laplacian operators in cylindrical, polar and spherical polar co-ordinates.

UNIT 2 : Complex Variables

Functions of a Complex variable – Single and mulitvalued functions – Analytic functions – Cauchy Riemann conditions – Singular points – Multivalued functions and Branch points – Cauchy's theorem and Integral formulae – Taylor and Laurent expansions – Zeros and poles – Residue theorem and its applications – Evaluation of definite integrals using Complex variables**.**

UNIT 3: Laplace and Fourier Transform

Laplace transform – Definition – Properties – Evaluation of Laplace transform and inverse Laplace transform – Solution of Linear differential equations with constant coefficients – Fourier integral – Fourier transforms – Fourier sine and cosine transforms – Convolution theorems – Applications.

UNIT 4: Tensors

Introduction - General Co-ordinate transformations – Einstein's summation convention - Scalars, Contravariant and Covariant vectors – Definition of Tensor – Tensor notation – Rank of a Tensor – Contravariant, Covariant and mixed

tensors – Kronecker delta and Levi-Cevita tensor in three dimensions. Christofell's symbols – Definition and transformation laws – Covariant derivatives – Derivatives of covariant and contravariant vectors - tensors of higher rank - Fundamental tensors and scalars.

UNIT 5 : Special functions

Generating function – Rodrigues formula – Recurrence relations – Orthogonality property for Bessel, Legendre, Laguerre, Hermite and Chebyshev functions – Spherical harmonics - Beta functions - Gamma Functions and their properties - Expansion of function in terms of orthogonal polynomials**.**

Text Books:

1. Sathyaprakash – Mathematical Physics with classical Mechanics–Sultan Chand & sons
2. B.D.Gupta – Mathematical Physics – Vikas Publishing House-4th edition (2009)

Reference Books:

1. M.Hamermesh - Group theory and its application to physical problems - Addison Wesley (1962)
2. M.D.Greenberg – Advanced Engineering mathematics – Pearson New International Edition – 2nd edition (2013)
3. E.Butkov – Mathematical Physics-Addison Wesley (1968).
4. B.S.Rajput – Mathematical Physics – 14th edition – Pragati Prakashan (2015)
5. A.W.Joshi – Matrices and Tensors in Physics – 3rd edition – Wiley Eastern Ltd. (2005)

18PPY13B	**CORE - II: NUMERICAL METHODS**	**SEMESTER - I**

Total Credits: 4
Hours per Week: 4

PREAMBLE:

- To solve the system of nonlinear equations using various numerical methods.
- To solve the ordinary and Partial Differential Equations.

COURSE OUTCOMES:

On the successful completion of the course, the student will be able to

CO Number	CO Statement	Knowledge Level
CO1	Find the numerical solution of nonlinear equations	**K1**
CO2	Solve the set of equations	**K2**
CO3	Know the concept of numerical differentiation and integration	**K3**
CO4	Solve the Ordinary Differential Equations	**K4**
CO5	Solve the Parabolic and Hyperbolic Partial differential equations	**K5**

Mapping with Program Outcomes:

CO's/POS	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S-Strong; M-Medium; L-Low

18PPY13B	**CORE - II: NUMERICAL METHODS**	**SEMESTER - I**

Total Credits: 4
Hours per Week: 4

CONTENT

UNIT – I: Solving Nonlinear Equations

Interval Halving (Bisection) Revisited - Linear Interpolation Methods - Newton's Method - Fixed - Point Iteration: $x = g(x)$ Method - Newton's Method for Polynomials.

UNIT – II: Solving Sets of Equations

Applications of Sets of Equations - Matrix Notation - The Elimination Method - The Gaussian Elimination and Gauss - Jordan Methods - Other Direct Methods - Iterative Methods.

UNIT – III: Numerical Differentiation and Numerical Integration

Extrapolation Techniques - Newton - Cotes Integration Formulas - The Trapezoidal Rule - A Composite Formula - Simpson's Rules.

UNIT – IV: Numerical Solution of Ordinary Differential Equations

The Spring-Mass Problem - A Variation - The Taylor-Series method - Euler and Modified Euler Methods - Runge-Kutta methods - Milne's method.

UNIT – V: Parabolic Partial-Differential Equations

Equation for the time dependent Heat Flow- The Explicit Method-The Crank Nicolson method a Generalization – The Theta method – Derivative Boundary conditions.

TEXT BOOKS:

1. Curtis F.Gerald and Patrick O.Wheatley, "Applied Numerical Analysis", Sixth Edition, 1999, Pearson Education Asia, New Delhi.

Unit – I	: Chapter 1: Sections 1.2 to 1.4, 1.6 - 1.7.
Unit – II	: Chapter 2: Sections 2.1 to 2.5, 2.10.
Unit – III	: Chapter 5: Sections 5.4 to 5.5, 5.6, 5.7
Unit – IV	: Chapter 6: Section 6.1 to 6.4., 6.6.
Unit – V	: Chapter 8: Sections: 8.1 to 8.5

REFERENCE BOOKS:

1. D. Samuel Conte, Carl. De Boor, "Elementary Numerical Analysis", 1983, McGraw- Hill International Edition.
2. Gordon D Smith, "Numerical Solution of Partial Differential Equations – Finite Difference Methods", 1985, Oxford University Press.
3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, "Numerical Methods for Scientific and Engineering Computation", Third Edition, 1993, Wiley Eastern Ltd.

18PPY13C	**CORE- III** **SOLID STATE PHYSICS**	SEMESTER I

Total Credits: 4

Hours per Week: 5

Preamble

To enable students to learn crystalline structure, and the concepts of semiconductor, Hall Effect.

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Understanding the lattice vibrations of a three-dimensional polyatomic vibrating crystal.	K2
CO2	Illustrate phonon-phonon interaction--density of phonon states- Debye's model of specific heat.	K3
CO3	Explain Fermi Dirac statistics, Fermi distribution function-Widemann-Franz law-Hall effect.	K2
CO4	Outline on the classification and theory of magnetic materials	K3
CO5	Discuss the theory on superconductivity and its applications.	K4

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	M
CO2	S	S	S	M	S
CO3	S	S	S	S	M
CO4	S	S	S	S	S
CO5	M	S	S	S	S

S-Strong; M-Medium; L-Low

18PPY13C	**CORE- III** **SOLID STATE PHYSICS**	SEMESTER I

Total Credits: 4

Hours per Week: 5

CONTENTS

UNIT 1: **Crystal Structure**

Crystalline and amorphous - Unit cell - Bravais lattices and crystal systems - Crystal directions - Miller indices - X-ray diffraction –Reciprocal lattice(SC,BCC,FCC) - Laue equations – diffraction conditions - Interpretation of Bragg's law and equation – The Rotating Crystal method – The Powder method – Neutron Diffraction

UNIT 2: **Lattice Vibrations**

Dynamics of a chain of identical atoms - Dynamics of a diatomic linear chain - An harmonicity and thermal expansion - Thermal conductivity - Phonon-phonon interaction - Normal and Umklapp process - Heat capacity - Density of phonon states - Classical model - Einstein's model - Debye's model of specific heat.

UNIT 3: Theory of Metals and Semiconductors

Free electrons gas in three dimensions - Electronic heat capacity – Wiedmann Franz law - Hall effect - Band theory of metals and semiconductors - Bloch theorem - Kronig-Penny model - Semiconductors - Intrinsic carrier concentration - Mobility - Impurity conductivity - Fermi surfaces and construction - Experimental methods in fermi surface studies - De Haas Van Alphen effect(DHVA).

UNIT 4: Magnetism

Elementary ideas of dia, para and ferro magnetism - Quantum theory of paramagnetism - Rare earth ion - Hund's rule - Quenching of orbital angular

momentum - Adiabatic demagnetization - Quantum theory of ferromagnetism - Curie point - Exchange integral - Heisenberg's interpretation of Weiss field - Ferromagnetic domains - Bloch Wall - Spin waves - Quantization - Magnons - Thermal excitation of magnons - Curie temperature and susceptibility of ferrimagnets - Theory of antiferromagnetism - Neel temperature.

UNIT 5: **Superconductivity**

Survey of important experimental results - Critical temperature - Meissner effect.- Type 1 and Type II superconductors-properties -Thermodynamics of superconducting transition - London equation- London penetration depth - Energy gap - Basic ideas of BCS theory - High-Tc superconductors - Applications.

Text Books:

1. S.O. Pillai, Solid State Physics, 6th Edition, New Age International, New Delhi(2002)
2. M.A.Wahab , Solid state physics, second edition, Narosa publishing house (2005)
3. Charles Kittel, Introduction to Solid State Physics, Wiley eastern limited, 7thedition.

Reference Books:

1. Ajay Kumar Saxena, Solid state physics, MacMillan Publishers(2006)
2. J.S.Blackmore, Solid state physics, second edition-Cambridge university press (1974)
3. A.J.Dekker, Solid State Physics, MacMillan India 1995.
4. Rita John, Solid State Physics, McGraw Hill ltd.

18PPY13D	**CORE- IV** **CLASSICAL MECHANICS**	SEMESTER I

Total Credits: 4

Hours per Week: 5

Preamble

To enable students to learn the concepts of Hamiltonian and lagrangain and canonical transformations.

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Apply Hamiltonian and lagrangain equation of motion to oscillator and pendulum	K2
CO2	Explain Kepler's Laws of Planetary motion and Rutherford Scattering cross section	K2
CO3	Summarize angular momentum and Euler's equations of motion.	K3
CO4	Understand the Hamilton Jacobi theory and action angle variables.	K3
CO5	Discussion on Canonical transformations , Lagrange and Poisson's brackets with simple examples	K4

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	M
CO2	S	S	M	S	S
CO3	S	S	S	S	M
CO4	S	M	S	S	S
CO5	S	S	S	S	M

S-Strong; M-Medium; L-Low

18PPY13D	**CORE- IV** **CLASSICAL MECHANICS**	SEMESTER I

Total Credits: 4

Hours per Week: 5

CONTENTS

UNIT 1: Langragian and Hamilitonian Formulation

Newton's equations and conservation laws for system of particles – Constraints – Generalised coordinates - D'Alemberts principle and Lagrange's equations of motion – Hamiltonian and Hamilton's equations of motion – Conservation of energy - Physical significance - Hamilton's principle of least action – Lagrangian and Hamilton equations of motion - Problems.

UNIT 2: Two Body Central Force Problem

Reduction of two body-Central force problem to equivalent one body problem - Equations of motion and first integrals – Kepler's Laws of Planetary motion and their deduction – Scattering by Central potential – Rutherford`s Scattering cross section - Transformation from centre of mass to laboratory frame.

UNIT 3: Mechanics of Rigid Bodies and Small Oscillations

Angular momentum and kinetic energy – Moment of Inertia tensor – Euler's angles – Euler's equations of motion – Torque free motion – Force free motion of a symmetrical top -Motion of a symmetrical top under gravity**.**

Small oscillations – Potential energy and equilibrium – One dimensional oscillator – Two coupled oscillators – General theory of small oscillations – Examples of two coupled oscillators – Vibrations of a linear triatomic molecule.

UNIT 4 : Hamilton-Jacobi Theory

Hamilton-Jacobi equation - Hamilton's principal function - free particle in Cartesian coordinates - Central force in spherical polar coordinates - Application to harmonic oscillator problem**.**

Action-Angles:

Kepler's problem - Action-angle variables - Simple harmonic oscillator – Oscillations - The eigenvalue equation - The principal axis transformation - Free vibrations - Normal coordinates - Linear triatomic molecule.

Unit 5: Canonical Transformation and Poisson brackets

Canonical transformations – Generating function – Properties of canonical transformations – Poisson brackets – Properties of Poisson brackets – Constant of motion using Poisson brackets – Poisson brackets of canonical variables – Poisson's Theorem – Invariance of Poisson bracket under canonical transformation – Motion as successive canonical transformation (Infinitesimal generators) – Liouville's theorem.

Text Books:

1. Sathyaprakash- Mathematical Physics with Classical Mechanics-Sultan chand & sons.
2. Herbert Goldstein-Classical Mechanics-Narosa Publishing House-2001.

Reference Books:

1. J.C Upadhyaya, Classical Mechanics-Himalaya - Pub; Mumbai (2012)
2. K.N.Srinivasa Rao , Classical Mechanics - Universities Press (India) Pvt Ltd (2003).
3. S.N Biswas, Classical Mechanics- - Books & Allied Ltd(2000).
4. P.V.Panat, Classical Mechanics , Narosa Publishers (2005)

18PPY13P	**CORE LAB- I** **GENERAL EXPERIMENTS**	SEMESTER I

Total Credits: 2

Hours per Week 4

List of experiments

1. Young's Modulus- Elastic constants of the material -Elliptical fringes
2. Determination of Specific Heat capacity of Liquid -Ferguson Method.
3. Spectrometer-Charge of an electron
4. Polarimeter-Optical activity of specific rotation
5. Compressibility of Liquid-Ultrasonic interferometer
6. Determination of refractive index of liquid-Air wedge
7. Determination of e/m by Solenoid method
8. Determination of Hall Effect
9. Determination of e/m by Thomson's method

18PPY13Q	**CORE LAB- II** **GENERAL ELECTRONICS LAB**	SEMESTER I

Total Credits: 2

Hours per Week: 4

List of experiments

1. IC Regulated and dual power supply

2. Construction of Hartley oscillator using OP-AMP

3. Construction of an Astable Multivibrator

4. Construction of Differentiator, Integrator circuit using OP-AMP

5. Construction of Adder, Subtractor, Sign Changer circuit using OP-AMP

6. Shift Register

7. Clipping, Clamping circuits

8. Differential Amplifier-OP-AMP

9. Characteristics of FET

10.Analog to digital Converter using Op-Amp

18PPY23A	**CORE- V** **APPLIED THERMODYNAMICS AND STATISTICAL MECHANICS**	SEMESTER II

Total Credits: 4

Hours per Week: 4

Preamble

To enable students to learn Schrödinger wave equation and apply quantum mechanics to one and three dimensional wave equations

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Introduce thermodynamics through thermodynamics postulates, quantities and relations	K2
CO2	Recall the micro and macroscopic properties of the mater through the statistical probability laws and distribution of particles	K3
CO3	Understand the classical and quantum distribution laws and their relations	K3
CO4	outline transport properties, different phases of maters, equilibrium and non- equilibrium process	K4
CO5	Explain the Classification of phase transitions	K5

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	S	S	S	M	S
CO3	S	S	M	S	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S-Strong; M-Medium; L-Low

18PPY23A	**CORE- V** **APPLIED THERMODYNAMICS AND STATISTICAL MECHANICS**	SEMESTER II

Total Credits: 4

Hours per Week: 4

UNIT 1: Thermodynamics, Microstates and Microstates:

Basic postulates of thermodynamics – Fundamental relations and definition of intensive variables – Intensive variables in the entropic formulation – Equations of state – Euler relation, densities - Gibbs-Duhem relation for entropy - Thermodynamic potentials– Maxwell relations – Thermodynamic relations – Microstates and macrostates – Ideal gas – Microstate and macrostate in classical systems – Microstate and macrostate in quantum systems – Density of states and volume occupied by a quantum state.

UNIT 2: Microcanonical, Canonical and Grand Canonical Ensembles: Microcanonical distribution function – Two level system in microcanonical ensemble – Gibbs paradox and correct formula for entropy – The canonical distribution function – Contact with thermodynamics - Partition function and free energy of an ideal gas –The grand partition function – Relation between grand canonical and canonical partition functions – One-orbital partition function.

UNIT 3: **Bose-Einstein, Fermi-Dirac and Maxwell-Boltzmann Distributions:**

Bose-Einstein and Fermi-Dirac distributions – Thermodynamic quantities – Non-interacting Bose gas and thermodynamic relations – Chemical potential of bosons – The principle of detailed balance – Number density of photons and Bose condensation – Thermodynamic relations for non-interacting Fermi gas – Fermi gas at zero and low temperature – Fermi energy and Fermi momentum -

Maxwell-Boltzmann distribution law for microstates in a classical gas - Physical interpretation of the classical limit – Fluctuations in different ensembles

UNIT 4 : **Transport and Non-equilibrium processes:** Derivation of Boltzmann transport equation for change of states without and with collisions – Boltzmann equation for quantum statistics – Equilibrium distribution in Boltzmann equation – Transport processes; One speed and one dimension - All speeds and all directions - Conserved properties - Distribution of molecular velocities – Equipartition and Viral theorems - Brownian motion - Non-equilibrium process; Joule-Thompson process – Free expansion and mixing - Thermal conduction - The heat equation.

UNIT 5: Heat capacities, Ising model, and Phase Transitions:

Heat capacities of heteronuclear diatomic gas – Heat capacities of homonuclear diatomic gas – Heat capacity of Bose gas –One-dimensional Ising model and its solution by variational method – Exact solution for one-dimensional Ising model - Phase transitions and criterion for phase transitions – Classification of phase transitions by order and by symmetry – Phase diagrams for pure systems – Clausius-Clapeyron equation – Gibbs phase rule.

Text Books:

1. Keith Stowe, An introduction to Thermodynamics and Statistical Mechanics, Cambridge University Press, 2 nd Edition, 2013
2. S.L.Kakani, Heat, Thermodynamics and Statistical Physics, S. Chand & Company
3. Kamal Singh & S.P. Singh , Elements of Statistical Mechanics, S. Chand & Company 1999

Reference Books:

1. Avijit Lahiri , Statistical Mechanics An Elementary Outline, University Press, Hyderabad,2002
2. Arnold Sommerfeld, Thermodynamic and Statistical Mechanics(Lecturers on the theoretical physics), Levant Books, Kolkatta.

18PPY23B	**CORE- VI** **QUANTUM MECHANICS - I**	SEMESTER II

Total Credits: 4

Hours per Week: 5

Preamble

To enable students to learn Schrödinger wave equation and apply quantum mechanics to one and three dimensional wave equations

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Explain basic concept and the application of Schrödinger wave equation	K2
CO2	Solve one dimensional problem and apply it to simple harmonic oscillator	K3
CO3	Apply quantum mechanics to three dimensional wave equations	K4
CO4	Generalization of Heisenberg and Schrödinger wave equations.	K2
CO5	Explain angular momentum and the system of identical particles	K3

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	S	S	S	M	S
CO3	S	S	M	S	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S-Strong; M-Medium; L-Low

18PPY23B	**CORE- VI** **QUANTUM MECHANICS - I**	SEMESTER II

Total Credits: 4
Hours per Week: 5

CONTENTS

UNIT 1: Basic Formalism

Schrodinger wave equation – Interpretation of wave function – Normalizable and non – normalizable wave functions – Box normalization – Admissibility conditions on the wave functions - Equation of continuity – Postulates of Quantum Mechanics – Ehrenfest's theorem – Stationary states – Representation of dynamical variables – Inner product – Commutator – Basic commutation relations – Expectation value – Adjoint of an operator – Self Adjoint operator – Eigen values and Eigen functions – Momentum wave functions – Uncertainty – Evolution of system with time – constants of motion.

UNIT 2: One Dimensional Problem

Particle in a box – Simple harmonic oscillator - Square well potential – Barrier penetration – simple harmonic oscillators - Potential Step.

UNIT 3: Three-dimensional problems

Orbital angular momentum – operator algebra – Eigen value spectrum of L^2 – Spherical harmonics – Central forces – Reduction of two body problem – Hydrogen atom – Particle in a spherical well.

UNIT 4: General Formalism

Representation theory-Dirac notation-Hilbert's space- Co-ordinate and momentum representations-Time evolution-Schrodinger, Heisenberg and

Interaction pictures-symmetries and conservation laws -unitary transformation associated with translations and rotations - Parity and time reversal.

UNIT 5: Angular Momentum and Identical Particles

Angular momentum algebra – Eigen value spectra – Addition of angular momenta – Clebsch – Gordon coefficients – Spin angular momentum – Matrix representation – Non-relativistic Hamiltonian including spin – Spin wave functions – Pauli's spin matrices.

System of identical particles – Symmetry and antisymmetry of wave functions – construction of symmetric and antisymmetric wave functions from unsymmetrised wave functions – Pauli's exclusion principle.

Text Books:

1. P.M. Matthews and K.Venkatesan – A textbook of Quantum Mechanics – McGraw Hill Education (India) Private Limited; 2 edition (2010)
2. A.K.Ghatak and S.Lokanathan – Quantum Mechanics – Theory and applications – 3rd edition – Macmillan Publisher (2012).
3. V.K.Thankappan – Quantum Mechanics – 3rd edition – New Age International Publishers (2012)

Reference Books:

1. Eugen Merzbacher – Quantum Mechanics - Wiley India Private Limited- 3rd edition (2011)
2. L.I.Schiff – Quantum Mechanics – 3rd edition - McGraw Hill Ltd (1968).
3. P.A.M.Dirac – The principles of Quantum mechanics – Igal Meirovich Pub (2013)
4. S.N.Biswas - Quantum Mechanics - Books & Allied Ltd; 2nd Revised edition (2012).

18PPY23C	**CORE- VII** **APPLIED SPECTROSCOPY**	SEMESTER II

Total Credits: 4

Hours per Week: 5

Preamble

To enable students to learn different spectroscopy and the relationship between them.

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the relationship between NMR, NQR spectra and can apply it for various applications.	K2
CO2	Discuss theory rated to ESR and Microwave spectroscopy.	K3
CO3	Relate IR and Raman spectra and symmetry of polyatomic molecules along with their electronic structure.	K4
CO4	Explain the principle of Mossbauer spectroscopy and extend it to various applications.	K2
CO5	Summarize the concept and the applications of surface spectroscopy	K3

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	M	S	S	S
CO3	S	S	S	S	M
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S-Strong; M-Medium; L-Low

18PPY23C	**CORE- VII** **APPLIED SPECTROSCOPY**	SEMESTER II

Total Credits: 4

Hours per Week: 5

CONTENTS

UNIT 1: NMR Spectroscopy

Theory of NMR method – Bloch equations- Steady state solution of Bloch equations- Theory of chemical shifts- Experimental methods –Single coil and double coil methods –Pulse method –High resolution method –Application of NMR to quantitative measurements.

NQR Spectroscopy

Quadrapole Hamiltonian –Nuclear quadrapole energy levels for axial and non-axial symmetry –Experimental techniques and applications.

UNIT 2: ESR Spectroscopy

Quantum mechanical treatment of ESR-Nuclear interaction and hyperfine structure-Relaxation effects-Basic principles of spectrographs-Application of ESR method.

Microwave Spectroscopy

Introduction – Experimental methods – Theory of microwave spectra of linear symmetric top molecules – Hyperfine structure – quadrupole moment – Stark modulation spectrometer**-** Inversion spectrum of the Ammonia

UNIT 3: IR Spectroscopy

Introduction – Theory of IR Absorption spectroscopy and energy levels. Instrumentation – Modes of vibration of atoms in polyatomic molecules. IR positions of various bond-vibrations – Applications of IR spectroscopy – Basic Principles of FTIR spectroscopy – FTIR spectroscopy.

Raman Spectroscopy

Introduction – Mechanism of Raman effect – classical theory of Raman effect – Effect of vibration – Effect of rotation – Quantum theory of Raman effect – Pure rotational Raman spectra – Vibrational – Rotational Raman spectra – Experimental techniques and applications – Laser Raman Spectroscopy - Laser Surface Enhancement resonance Spectroscopy.(LSERS)

UNIT 4: Molecular Mechanics

Introduction – Theory – Formulation – Bond – Stretching – Angle bonding – Torsional angles – Van der Waals – electrostatics – Cross terms – Heats of formation – Parameterization – Evaluation of Heats of Formation and strain energies**.**

Mossbauer Spectroscopy

Principles of Mossbauer spectroscopy - chemical shift - Quadrupole splitting and Zeeman splitting - Simple chemical applications of Mossbauer spectroscopy.

UNIT 5:

Surface Spectroscopy

Electron energy loss spectroscopy (EELS)- Reflection - Absorption –IR Spectroscopy (RAIRS) - Inelastic Helium Scattering – Photo electron spectroscopy (PES) – X-Ray (XPES) –Ultra-Violet (UPES)- Auger Electron Spectroscopy (AES) – X-Ray Fluorescence (XRF)-`Applications.

Text Books*:*

1.C.N.Banwell – Fundamentals of Molecular Spectroscopy – 4th edition - Tata McGraw Hill, NJ (1994).

2. G.Aruldhas – Molecular structure and Spectroscopy Prentice Hall,New Delhi (2007).

3. Walker and Straughan –Spectroscopy-Vols-I&II, Chapman, London (1976)

Reference Books:

1. M.C Gupta, Atomic and Molecular Spectroscopy, New Age International (2007)

2. Slitcher, Harper and Row, Principles of Magnetic Resonance 3rd edition, Springer Science & Business Media (2013)

3. Goldanskill, Mossbauer Effect and its Application to Chemistry Vol I, Springer; Softcover reprint of the original 1st ed. 1964 edition (2012)

4. T.P. Das and Hahn, Nuclear Quadrapole Resonance Spectroscopy, EEL,Academic (1958).

18PPY23D	CORE- VIII NUCLEAR AND PARTICLE PHYSICS	SEMESTER II

Total Credits: 4
Hours per Week: 4

Preamble

To enable students to learn properties of nuclear forces and elementary particles.

Course Outcomes
On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Understanding the structure of nuclei through nuclear models.	K2
CO2	Classify and explain alpha, beta and gamma decay based on theory	K3
CO3	Recall on the properties of nuclear forces and determine phase shift	K2
CO4	Simplify nuclear reaction dynamics and its mechanism.	K3
CO5	Illustrate on the account on the elementary particles.	K4

Mapping with Programme Outcomes

COs / Pos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	S	S	S	S

S-Strong; M-Medium; L-Low

18PPY23D	CORE- VIII NUCLEAR AND PARTICLE PHYSICS	SEMESTER II

Total Credits: 4
Hours per Week: 4

CONTENTS

UNIT – 1 : Basic Properties of Nucleus

Nuclear size, angular momentum, magnetic dipole moment, electric quadrupole moment – Experimental determination - parity - Nuclear mass – mass synchrometer – binding energy – Weizasckar's semi empirical mass formula – Nuclear stability – mass parabolas – shell model of the nucleus – shell structures – predictions of shell model .

UNIT – 2: Radioactivity

Potential well – Alpha decay – Gamow's theory of alpha decay – Geiger – Nuttal law – Beta ray spectrum – Neutrino hypothesis – Fermi's theory of Beta theory – Kurie plot – Coulomb effect on beta decay – Fermi and GT selection rules – Non-conservation of parity in beta decay Gamma decay – Internal conversion – Nuclear isomerism – Multipole radiations – Angular momentum and parity of nuclear levels.

UNIT – 3 : Two Body Systems and Nuclear Forces

General properties of nuclear forces – Charge independence and spin dependence of nuclear forces – Exchange forces – Yukawa's theory – Theory of ground state of deuteron – predictions about the n-p interaction – photodisintegration of deuteron – nuclear scattering cross sections – low energy n-p scattering – phase shift analysis, scattering length and effective range – Determination of the phase shift – partial wave analysis of n-p scattering – Born approximation.

UNIT – 4: Nuclear Reactions and Nuclear Energy

General feature of cross sections – inverse reaction and detailed balance – The compound Nucleus – energy levels – Excitation energy of the compound nucleus – Resonance reaction – Briet – Wigner and level formula – Liquid drop model of the nucleus – nuclear fission – Features of nuclear reactor design – Neutron diffusion equation – Super and subcritical reactors.

UNIT – 5: **Elementary Particles**

Classification of elementary particles – Decay modes – General idea of strong weak and electromagnetic interactions – Conservation law – Strangeness – Gellman – Nishigama relation – Electro-weak interaction – Higg's mechanism– SU_2, SU_3 symmetry – Quark model.

Text Books:

1. Tayal D.C. 2011. Nuclear Physics. Himalaya Publishing House, Mumbai

2. Roy R.R and Nigam B.P., Nuclear Physics, New Age International, Chennai, Edition 1 (2008).

3. Blatt J.M. Weisskopf .V .F - Theoretical Nuclear Physics, (1952). (New York and London: John Wiley & Sons).

4. Harold A. Enge- Introduction to Nuclear Physics, (1969). Addison - Wesley, - Publishing Company. Inc. Reading. New York,

Reference Books

1. Irving Kaplan – Nuclear Physics – 1989 – 2nd Ed. – Narosa (2002), Addison Wesley Publishing Company

2. Bernard L Cohen – Concepts of Nuclear Physics – (2001)- McGraw Hill Education (India) Private Limited; 1 edition .

18PPY23P	**CORE LAB- III** **GENERAL EXPERIMENTS**	SEMESTER II

Total Credits: 2
Hours per Week: 4

List of experiments

1. Young's Modulus- Elastic constants of the material -Hyperbolic fringes

2. Determination of Planck 's constant

3. Determination of refractive index of liquid - He-Ne laser.

4. Determination of e /m-Thomson method

5. Determination of Rydberg's constant- Solar spectrum

6. Determination of Viscosity of Liquid –Mayer's Disc Method

7. Characteristics of solar cell

8. Determination of stefan's constant

9. Determination of specific heat capacity of metal-Forbe's Method.

10. Characteristics of LDR

18PPY23Q	**CORE LAB- IV** **SPECIAL ELECTRONICS LAB**	SEMESTER II

Total Credits:2
Hours per Week: 4

List of experiments

1 . Construction of Colpitt's Oscillator using Op-Amp

2. Construction of Bistable Multivibrator

3. Schmitt Trigger using OP-Amp

4. Characteristics of UJT

5. Inverting, Non-inverting, Voltage Follower using OP-AMP

6. Characteristics of Tunnel Diode

7. Analog to Digital converter using IC 74148

8. Log amplifier using OP-AMP

9. Op-AMP-current t voltage and Voltage to current converter

10.Low pass, High pass and Band pass Filter using OP-Amp

11. Waveform generator using OP-AMP

18PPY33A	CORE- IX QUANTUM MECHANICS – II	SEMESTER III

Total Credits: 4
Hours per Week: 5

Preamble

To enable students to learn and apply the basic Klein-Gordon equation and Dirac equation.

Course Outcomes
On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Outline on the approximation methods and its applications.	K2
CO2	Explain the scattering theory and Partial wave analysis	K2
CO3	Make use of time independent perturbation theory and its simple applications.	K3
CO4	Discuss the Klein-Gordon equation, Dirac equation and interpretation of negative energy states.	K3
CO5	Interpret Euler lagrange and Hamiltonian formulation.	K4

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	M	S
CO2	S	S	M	S	S
CO3	S	S	S	M	S
CO4	S	S	S	S	M
CO5	S	M	S	S	S

S-Strong; M-Medium; L-Low

18PPY33A	**CORE- IX** **QUANTUM MECHANICS – II**	SEMESTER III

Total Credits: 4
Hours per Week:5

CONTENTS

UNIT 1: Approximation Methods

Time independent perturbation theory – Non degenerate energy levels – 1st and 2nd order – Degenerate energy levels –Variation method – Simple applications – WKB approximation – Connection formulae (no derivation) – WKB quantization – Application to simple harmonic oscillator – Hydrogen molecule, covalent bond and hybridization.

UNIT 2: Scattering theory

Introduction – Scattering amplitude – Cross sections – Born approximation – Partial wave analysis – Effective range theory for s wave – Optical theorem – Transformation from centre of mass to lab frame.

UNIT 3: Time Dependent Perturbation Theory

Introduction – Transition probabilities – Constant and harmonic perturbations – Transition probabilities – Fermi's golden rule – Selection rules for dipole radiation – Adiabatic approximation – Sudden approximation – Density matrix – Spin density matrix – Magnetic resonance – Semi-classical treatment of an atom with electromagnetic radiation

UNIT 4: Relativistic Quantum mechanics

Klein-Gordon equation – Continuity equation – Plane wave solutions – Dirac equation – Dirac matrices – Equation of continuity – Spin of Dirac particle – Plane wave solutions – Interpretation of negative energy states – Antiparticle –

Magnetic moment of an electron due to spin - Covariant form of Dirac equation – Properties of Gamma matrices – Relativistic invariance of Dirac equation.

UNIT 5: Classical Fields and Second Quantization

Classical fields – Euler Lagrange equations – Hamiltonian formulation – Noether's theorem - Quantisation of real and complex scalar fields - creation, destruction and number operators - Fock states - Second Quantisation of K.G. field.

Text Books:

1. P.M. Matthews and K. Venkatesan – A textbook of Quantum Mechanics – McGraw Hill Education (India) Private Limited; 2 edition (2010)
2. L.I. Schiff – Quantum Mechanics – 3rd edition - McGraw Hill Ltd (1968)
3. J.D. Bjorken & S.D. Drell - Relativistic Quantum mechanics - McGraw Hill Book Co.(1967)
4. V.K. Thankappan – Quantum Mechanics – 3rd edition – New Age International Publishers (2012)
5. G. Aruldhas – Quantum mechanics - Prentice hall of India Pvt.Ltd -2nd edition (2008)

Reference Books:

1. J.L. Powell & B. Crasemann, Quantum Mechanics- Addison-Wesley Pub (1961)
2. P.A.M. Dirac – The Principles of Quantum mechanics – Igal Meirovich Pub (2013)
3. L.D. Landau and E.M. Lifshitz – Quantum Mechanics – Pergamon 3rd edition (2013).

18PPY33B	**CORE- X** **ADVANCED ELECTRONICS**	SEMESTER III

Total Credits: 4
Hours per Week: 5

Preamble

To enable students to learn and apply the basic semiconductor devices through experiments in laboratory

Course Outcomes
On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Recall on the basic semiconductor devices such as FET, UJT, MOSFET and its applications.	K2
CO2	Demonstrate flip flops and Synchronous counters. Identify Shift Registers using JK / D Flip Flop	K3
CO3	Discuss the working of OP-AMP through experiments in laboratory and summarize its applications	K2
CO4	Generate waveforms through experiments in laboratory and Explain various filters.	K4
CO5	Interpret D/A and A/D Converters and successive approximation method	K4

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	M	S	S	S	S
CO3	S	S	S	M	S
CO4	S	S	S	S	M
CO5	S	S	S	S	M

S-Strong; M-Medium; L-Low

18PPY33B	**CORE- X** **ADVANCED ELECTRONICS**	SEMESTER III

Total Credits: 4
Hours per Week: 5

CONTENTS

UNIT 1: Semiconductor Devices and Their Applications

FET Construction and Characteristics - FET as a Voltage Variable resistor – FET biasing – Common source amplifier at low frequencies - MOSFETS - Depletion and enhancement modes - MOSFETS as switches and resistors - UJT Saw tooth wave Generator - Tunnel diodes – Energy band diagrams - Characteristics - Application of tunnel diode as switches - Gunn Diode and IMPATT diode - Construction and operation - SCR.

UNIT 2: Sequential Logic Circuits and Memories

Flip-flops: RS, D-type, JK and Master - Slave Flip-flop – Counters - Asynchronous - Synchronous - Modulus counters – BCD Counter - Registers - Shift right, Shift left registers - Ring counter – Johnson's ring Counter. Semiconductor memories – ROM, EPROM, EEPROM – RAM – Static and Dynamic RAM.

UNIT 3: Basic Applications of Operational Amplifier

Preliminary introduction to amplifiers - Voltage to current & current to voltage converters – Integrator & differentiator – Comparators - Solution of simultaneous equations and differential equations – Instrumentation amplifier – Logarithmic amplifier - Antilog amplifier –Analog multiplication and Division.

UNIT 4: Waveform Generators and Active Filters

Active Filters – Introduction – Butterworth - First order LPF and Second order LPF – Band pass filters – Waveform generation – Generation of square, triangular

and sine waves – Schmitt Trigger TIMER 555: Internal architecture and working - Timer 555 as Schmitt trigger, Astable and Monostable Multivibrator - Phase locked loops.

UNIT 5: D/A and A/D Converters

Introduction – Binary weighted DAC – R/2R Ladder DAC accuracy and resolution - A/D converter – Simultaneous conversion - Counter method - Continuous method – Successive approximation - Dual slope A/D converters - Accuracy and resolution.

Text Books:

1. Herbert Taub and Donald Schilling - Digital Integrated Electronics - McGraw Hill International Ed (1977).
2. Jacob Millman and Christos C. Halkias - Integrated Electronics: Analog and Digital Circuits and Systems -McGraw – Hill Book Company (2011).
3. S.M. Sze - Semiconductor Devices – Physics and Technology - John Wiley, New York. (2008)
4. Malvino & Leach - Digital Principles and Applications - 4th Ed. -Tata McGraw Hill, NewDelhi. (2015)

Reference Books:

1. M. Sayer and A. Mansingh - Measurement, Instrumentation and Experimental Design in Physics Engineering – Prentice - Hall India, New Delhi (2000).
2. B. Somanath Nair - Digital Electronics and Logic Design (2002).

18PPY33C	**CORE-XI** **ELECTROMAGNETIC THEORY**	SEMESTER III

Total Credits: 4

Hours per Week: 4

Preamble

To enable students to learn and apply the basic electrostatics laws and Electromagnetic waves in conducting media.

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Recall on the basic electrostatics laws, Green theorems and Green's Function and Laplace equations	K2
CO2	Discuss dielectrics, Guass law in dielectrics and electrostatic energy	K2
CO3	Illustrate the magnetostatic energy and its related laws	K3
CO4	Outline on Maxwell equation in free space and matter, Physical significance and Introduction to four vectors	K3
CO5	Explain the Electromagnetic waves in conducting media and Laws of reflection and refraction for em waves	K4

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	M	S
CO4	S	S	S	M	S
CO5	S	S	S	S	M

S-Strong; M-Medium; L-Low

18PPY33C	**CORE-XI** **ELECTROMAGNETIC THEORY**	SEMESTER III

Total Credits:4

Hours per Week: 4

CONTENTS

UNIT 1: Electrostatics and Boundary Value Problems

Introduction to Electrostatics – Gauss law – Electrostatic potential – Poisson's and Laplace equations – Green's theorem – Green's functions – Potential with Dirichlet and Neumann boundary conditions – Solution of Laplace's equation in rectangular box – Solution by separation in spherical polar coordinates – Multipole expansion

UNIT 2: Electrostatics in Matter

Electrostatic field in matter – Dielectrics – Polarization – Polarization vector – Field outside polarized dielectric – Bound charges – Electric displacement vector – Gauss law in presence of dielectrics – Linear dielectrics – Boundary conditions in dielectric media – Electrostatic energy in presence of dielectrics – Alignment of polar molecules – Dielectric sphere in uniform electric field – Molecular polarizability and electrical susceptibility

UNIT 3: Magnetostatics

Introduction to Magneto statics – Conservation of charge and equation of continuity – Biot-Savart's law – Magnetic field due to a localized current distribution – Ampere's law – Magnetic vector potential – Magnetic scalar potential – Magnetic moment, force and torque on a current distribution in an external field – Magnetization – Field of a magnetized object – Bound currents – Auxiliary field H – Linear media – Magnetostatic energy – Uniformly magnetized sphere – Multipole expansion

UNIT 4: Maxwell's Equations

Equation of continuity in electrodynamics – Faraday's law of induction – Maxwell equations – Maxwell displacement current – Maxwell equation in free space and matter – Physical significance – Boundary conditions – Vector and scalar potentials - Gauge invariance – Wave equation and plane wave solutions – Coulomb and Lorentz gauges – Energy and momentum of the field – Maxwell's stress tensor – Conservation laws for a system of charges and electromagnetic fields – Introduction to four vectors - D' Alembertian Operator – Maxwell's Field equations in four vector form – Current four vector - Invariance of Maxwell's equations

UNIT 5: Wave Propagation

Plane waves in a nonconducting media – Electromagnetic waves in conducting media – Reflection and refraction of em waves at a plane interface – Laws of reflection and refraction for em waves – Propagation of em waves between parallel and perfectly conducting planes – Rectangular wave guide and circular wave guide - Inhomogeneous wave equation and retarded potentials – Oscillating electric dipole – Energy radiated by an oscillating electric dipole.

Text Books:

1. David. J.Griffiths, Introduction to Electrodynamics, Pearson Education; 4 edition (2015)
2. J.D. Jackson, Classical Electrodynamics, 3rdedition – John Wiley & Sons (2007)
3. B.B. Laud, Electromagnetics, New Age International Publisher; 3rd edition (2011)
4. Chopra and Agarwal, Electromagnetic theory, Kadernath and Ramnath & Co. Meerut.

Reference Books:

1. J.R. Reitz, F.J. Milford and R.W. Christy – Foundations of Electromagnetic theory – 3rd edition – Addison Wesley (1980).

2. Sathya Prakash, Electromagnetic Theory and Electrodynamics, Kadernath Ramnath & Co., Meerut, 2007.

18PPY33P	**CORE LAB- V** **ADVANCED GENERAL EXPERIMENTS**	SEMESTER III

Total Credits: 2

Hours per Week :4

List of experiments

1. Determination of Susceptibility by Quinke's method

2. Dielectric loss using CRO

3. Determination of Refractive index of liquid - Newton's ring

4. Study of PN junction - Determination of reverse saturation and material constant

5. Study of PN junction - Study of depletion capacitance and its variation with reverse bias

6. Spectrometer - Double slit

7. Determination of Audio Frequency - Bridge method

8. Determination of high conductivity – Four probe method

9. Determination of Hartman's formula

10. Determination of wavelength of laser source – transmission grating

11. Determination of wavelength of laser source - reflection grating

18PPY33Q	**CORE LAB- VI** **ADVANCED ELECTRONICS LAB**	SEMESTER III

Total Credits: 2

Hours per Week: 4

List of experiments

1. Sine wave oscillator using OP-AMP

2. Binary adder weighted resistor- using OP-AMP

3. Common source drain using FET

4. Phase shift oscillator using OP-AMP

5. Binary adder and Subtractor using IC 7483 and IC 7486

6. Design of MOD 3 and MOD 5 counter using JK flip flop

7. Wave shaping circuit.

8. Characteristics of Photodetector

9. Voltage doubler

10. Common source amplifier using FET

11. UJT – Relaxation Oscillator

12. Dual slope Digital to Analog converter using OP-AMP

18PPY43A	**CORE- XII** **MICROPROCESSOR AND ITS APPLICATIONS**	SEMESTER IV

Total Credits: 3

Hours per Week: 5

Preamble

To enable students to learn and apply the basic microprocessor architecture and various instructions set.

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the microprocessor architecture and the various instructions set.	K2
CO2	Develop the skill of programming with 8085	K3
CO3	Learn about the additional instructions in programming techniques, Counters and time delays.	K3
CO4	Explain the various and I/O and memory devices	K2
CO5	Apply the 8085 Microprocessor in everyday life through experiments in laboratory.	K4

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	M	S
CO4	S	S	S	S	M
CO5	S	S	S	M	S

S-Strong; M-Medium; L-Low

18PPY43A	**CORE- XII** **MICROPROCESSOR AND ITS APPLICATIONS**	SEMESTER IV

Total Credits: 3

Hours per Week: 5

CONTENTS

Unit - I: **8085 Microprocessor**

Internal architecture of 8085 - Addressing modes - Direct- Indirect - register addressing- register indirect addressing- Immediate addressing - Instruction set - programming technique - Interrupts of 8085.

Unit - II: **Programming with 8085**

Addition - Subtraction and multiplication - Square and square root- BCD to Binary conversion - Binary to BCD conversion - Bubble sort method- largest and smallest - Ascending and Descending order – Sum of series - Time delay subroutine - Clock program.

Unit -III: Programming Techniques with Additional Instructions

Programming techniques; Looping, counting and indexing – Additional Data transfer and 16-bit Arithmetic instructions – Arithmetic operations Related to Memory – Logic operations: rotate – Logic operations; Compare – dynamic Debugging.

Counters and Time Delays

Counter and Time delays – illustrations five program; Hexadecimal counter - Illustrative program: Generating pulse wave forms – Debugging counter and Time – Delay programs.

Unit -IV: **Interfacing Memory and Peripherals**

Basic interfacing concepts - Peripheral I/O instructions - Device select and data transfer - I/O mapped I/O - Memory mapped I /O - Interfacing of ROM, RAM and EPROM chips - Interfacing of 8255.

Unit -V: **Interfacing Applications**

Seven Segment Display interface- Keyboard interface- Interfacing to Digital to Analog Converter (DAC)- Analog to Digital Converter (ADC)- Stepper Motor interface-Hardware Controlled Serial I/O using programmable chip 8251 (USART).

Text Books:

1. Ramesh Goankar- Microprocessor Architecture, programming and applications with the
   8080A/8085, Penram International Publishing- 5th edition (2000)
2. Doughlas V. Hall – Microprocessor Interfacing Programing and Hardware, McGraw-Hill Inc.,US- 2nd Revised edition (1990)
3. Mohammed Rafiquzzaman- Microprocessor and Microcomputer based system-CRC Press (2008)
4. Kenneth J. Ayala- The 8051 Microcontroller Architecture, Programming and Applications- Cengage Learning (2004)

Reference Books

1. L.A. Leventhal: Introduction to Microprocessor Hardware, Software, programming.

18PPY43B	**CORE- XIII** **NANOTECHNOLOGY**	SEMESTER IV

Total Credits: 3
Hours per Week: 5

Preamble

To enable students to learn basic concept and the properties of Nanoparticles

Course Outcomes
On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Recall on the basic concept and the properties of Nanoparticles	K2
CO2	Discuss the 1D, 2D, 3D nanoparticles and Properties dependent on density of states	K2
CO3	Interpret the various methods to produce nanomaterials.	K3
CO4	Summarize the various characterization techniques.	K3
CO5	Brief the theory and the applications of nanomaterials in various fields	K4

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	M	S
CO4	S	M	S	S	S
CO5	M	S	S	S	S

S-Strong; M-Medium; L-Low

18PPY43B	**CORE- XIII NANOTECHNOLOGY**	SEMESTER IV

Total Credits: 3
Hours per Week: 5

CONTENTS

Unit -I: Introduction

Definition of nanoscience and background – Importance of nanoscience – Atomic structures – Nanoscale systems – Number of atoms on the surface – Effects of small size – Physical and chemical properties - Electronic - structural - mechanical - Optical - Magnetic properties – Applications.

Unit -II: Conduction in confined geometries

Nanomaterials - 2D, 1D, 0D - size and dimensionality effects - Potential wells - Partial confinement - Properties dependent on density of states - Excitons - Single electron tunneling - Applications - Infrared detectors - Quantum dot lasers.

Unit -III: Preparation of Nanomaterials

Top down and bottom up approach - Plasma arcing – Hydrothermal- Sol gel process - Ball milling - Film formation – Physical vapour deposition – Evaporation – Sputtering – Chemical vapour deposition – Electro deposition - Lithography – Photo lithography – E-beam lithography.

Unit -IV: Characterization Techniques

Raman Spectroscopy - FTIR spectroscopy - X-ray Diffraction(XRD) - Small Angle X-ray Scattering (SAXS) - Scanning Electron Microscopy (SEM) - Transmission Electron Microscopy (TEM) - Scanning Probe Microscopy (SPM) - Atomic Force Microscopy (AFM) - Absorption and Transmission spectroscopy - Photoluminescence (PL).

Unit -V: Significant Nanomaterials and Applications

Molecular electronics and nano electronics - Nanobots - Biological applications of nanoparticles - Catalysis - Band gap engineered quantum devices - nanomechanics - Carbon nanotubes emitters - fuel cells - photonic crystals and Plasmon waveguides.

Text Books:

1. CP Poole and FJ Owens, Introduction to Nanotechnology John Wiley & Sons(2007)
2. Supriya Datta, Quantum Transport Cambridge University Press (2015)
3. Guozhong Cao, Nanostructures and Nanomaterials Synthesis, Propertiesand Applications - World Scientific (2011)
4. Richard Booker and Earl Boysen, Nanotechnology, John Wiley & Sons- 2nd Edition (2011).

Reference Books

1. Pradeep T- Nano: The Essentials- Tata McGraw-Hill Publishing Co.(2012)

2.Mick Wilson , Kamali Kannangara , Geoff Smith , Michelle Simmons , Burkhard Raguse -Nanotechnology, Chapman and Hall/CRC (2002).

3. Hand book on Nanotechnology – A.G. Brecket, 1st Edition 2008, Dominant publishers and distributors, 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).

18PPY43P	**CORE PRACTICAL - VII** **MICROPROCESSOR LAB**	SEMESTER IV

Total Credits: 2

Hours per Week: 5

List of experiments

1. 8085 ALP for 8 bit Addition and Subtraction
2. 8085 ALP for 8 Bit Multiplication and Division
3. 8085 ALP for finding the biggest and smallest number element in the array
4. 8085 LED Interfacing
5. 8085 Traffic Light Controller and Stepper Motor controller
6. 8085 ALP for sorting the element in the array in ascending and descending order.
7. 8085 ALP- OP-AMP as triangular and square wave generator
8. 8085 ALP – Masking off most significant four bits and setting bits using two different instructions.
9. 8085 Elevator Controller

18PPY1EA	**ELECTIVE-I** **BIO MEDICAL INSTRUMENTATION**	SEMESTER I

Total Credits: 4

Hours per Week: 4

Preamble

To enable students to learn and apply the concept of various imaging systems and its working

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Recall on the basic concept of pressure and human digestive system.	KI
CO2	Infer blood pressure and explain the characteristics and measurement of blood flow, pacemakers.	K2
CO3	Explain the concept of physics behind the breathing mechanism and lungs.	K3
CO4	Outline on the application of electricity and magnetism in medicine.	K3
CO5	Summarize various imaging systems and its working in biomedical field.	K4

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	M	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S-Strong; M-Medium; L-Low

18PPY1EA	**ELECTIVE-I** **BIO MEDICAL INSTRUMENTATION**	SEMESTER I

Total Credits: 4

Hours per Week: 4

CONTENTS

Unit 1: Effects of Pressure on Human System

Measurement of pressure in the human body - Pressure inside the skull - Trans illumination - Eye pressure - Tonometers - Ophthalmoscopy - Pressure in the digestive system - urinary bladder - Pressure in the skeletal system - Stress and strain - Strain gage - Transducers for biomedical applications.

Unit 2: Physics of lungs and breathing

The airways - Interaction of the blood and the lungs - Measurement of pulmonary volume - Volume relationships of the lungs - Physics of alveoli - breathing mechanism - Pulmonary flow - Pulmonary diffusion - Airway resistance - Measurement of airway resistance - Work done in breathing - measurement of gaseous exchange and diffusion - Respiratory therapy equipment - Physics of some common lung disease.

Unit 3: Physics of Cardiovascular System

The heart and cardiovascular system - Oxygen and CO_2 exchange - Work done by heart - Pressure across the blood vessel - Characteristics of blood flow - Heart sounds - Blood pressure measurement - Indirect measurements - Direct measurements - Percutaneous insertion - Catheterization implantation of transducer - Measurement of blood flow and cardiac output - Elements of intensive care monitoring - Pacemakers - Defibrillators.

Unit 4: Application of electricity and magnetism in medicine

The nervous system and neurons - source of bioelectric potentials - Testing and action potentials - Propagation of action potentials - Electrodes - Theory - Biopotential electrodes - Electro-Myogram - Electrocardiogram - electroencephalogram – Electro-oculogram magneto-cardiogram - Thermography and skin temperature measurements - Applications of high frequency and electricity in medicine.

Unit 5: Medical Imaging Techniques

X-rays and radio isotopes - Instrumentation - X-rays in diagnosis - Medical application of radioisotopes - Radiation therapy - Principles of ultrasonic measurement - Ultrasonic diagnosis - Magnetic Resonance Imaging (MRI) - Computerized Axial Tomography scanners (CAT) - Positron Emission Tomography (PET) imaging - Physiological effects of electric current - Shock hazards - Methods of accident prevention.

Text Books:

1. J.R. Cameron and James G. Skofronick, Medical Physics, John Wiley & Sons Inc.(1978)
2. A.C. Damask, Medical Physics, Vol I &Vol II, Academic Press (1978, 1981)
3. John G. Webster, BioInstrumentation, John Wiley & Sons, Inc. (2008)
4. W. Hoppe, W. Lohmann, H. Markl, H. Ziegler, Biophysics, Springer Science & Business Media (2012).

Reference Books:

1. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, Prentife -Hall of India Pvt. Ltd. (2007).
2. Arumugam M., Biomedical Instrumentation, Anuradha publications, (2007)
3. A.J.Vander, J.H. Sherman and D.S. Lucian, Human Physiology, McGraw – Hill (International Edition) (1986).

18PPY1EB	ELECTIVE-I LASER PHYSICS AND FIBER OPTICS	SEMESTER I

Total Credits: 4

Hours per Week: 4

Preamble

To enable students to learn and apply the basic principle of laser and the concept of fiber optics.

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Recall on the basic principle of laser and its working	K1
CO2	Classify the types of lasers based on the construction and working	K2
CO3	Summarize the application of laser in everyday life.	K3
CO4	Interpret on the concept of fiber optics and its classification	K4
CO5	Discuss the fire optic communication system, couplers and splicing	K4

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	M	S
CO4	M	S	S	S	S
CO5	S	S	M	S	S

S-Strong; M-Medium; L-Low

18PPY1EB	**ELECTIVE-I** **LASER PHYSICS AND FIBER OPTICS**	SEMESTER I

Total Credits: 4

Hours per Week: 4

CONTENTS

Unit 1: Laser Physics

Basic principles of laser - Einstein Coefficients - Condition for light amplification - Population inversion - Threshold condition - Line shape function - Optical resonators (Qualitative only) - Three level & four level systems.

Unit 2: Types of Lasers

Principle, Construction and Applications : Ruby Laser - Nd - YaG Laser - He-Ne Laser, CO_2 Laser - Dye Laser – Semiconductor Laser

Unit 3: Application of Lasers

Holography - Theory of recording & reconstruction - Applications of holography - Holographic interferometry in non-destructive testing, Acoustic holography and Holographic microscopy. Application of Laser in industry - Materials processing – drilling, cutting, welding, alloying, glazing, surface hardening, annealing. Laser Tracking – Lidar. Laser speckle and Shearography – SNDT (Speckle Non-Destructive Testing) – Laser Ablation – Laser chemical vapour deposition (LCVD) – Laser thermal deposition

Medical applications - Laser as diagnostic & therapeutic tool - Medical applications Lasers in Science**:** Lasers in compact disc players- Laser fusion– Isotope separation – Photo-chemical applications

Unit 4: Optic Fibers

Basic structure of an Optic fiber - Acceptance angle - Numerical aperture - Propagation of light through an optical fiber - Theory of modes formation -

Classification of fibers - Step index & graded index fibers - Comparison of the two types - Single mode & multimode fibers - Losses in fibers - Dispersion in fibers - Fabrication of fibers.

Unit 5: Fiber Optic Communications

Optical communication - Communication systems (Block diagram) - Advantages -Light sources - Modulation methods – Photo detectors - Optical couplers - Splicing -Repeaters - Fiber cables - Optical time domain reflectometers**.**

Text Books:

1. K. Thyagarajan, A.K. Ghatak - Lasers, theory and applications, Plenum Publishing Corporation, New York (1981) Reprinted by Macmillan India Ltd. (1984).
2. Avadhanulu M.N., - An introduction to Lasers, theory & applications, S.Chand & Co, New Delhi (2001).
3. K. Thyagarajan and Ajoy Ghatak, Lasers: Fundamentals and Applications, Springer, USA (2010)
4. Subir Kumar Sarkar - Optical fibres & Fibre optic communication systems, Chand (S.) & Co Ltd ,India; 4th Revised Edn. (2007)
5. R.K. Gaur & S.L. Gupta (eighth edition) - Engineering Physics, Dhanpat Rai and Sons Publications, New Delhi (1987).
6. P.K. Palanisamy - Physics for Engineering, Scitech Publications-Chennai (2008)

Reference Books:

1. Ajoy Ghatak & K. Thygarajan, - Introduction to Fibre Optics, CambridgeUniversity Press (1987).
2. John Crisp- Introduction to Fiber Optics, Newnes Publishers - 3rd edition (2005)

18PPY2EA	**ELECTIVE-II** **CRYSTAL GROWTH, THIN FILM AND PLASMA PHYSICS**	SEMESTER II

Total Credits: 4

Hours per Week: 4

Preamble

To enable students to learn various experimental techniques for crystal growth and thin films.

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Explain various theory related to crystal growth	K1
CO2	Determine various experimental techniques for crystal growth	K2
CO3	Summarize various preparation methods of thin films.	K3
CO4	Conclude the application of thin films in various fields.	K3
CO5	Discuss fourth state of matter, theory behind plasma and its applications.	K4

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	M	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S-Strong; M-Medium; L-Low

18PPY2EA	**ELECTIVE-II** **CRYSTAL GROWTH, THIN FILM AND PLASMA PHYSICS**	SEMESTER II

Total Credits: 4
Hours per Week: 4

CONTENTS

UNIT – 1: Theories of Crystal Growth

Nucleation Concept- Kinds of nucleation – Classical theory of nucleation - Surface energy theory – Diffusion theory – Bravis and Kossel theory – Stranski's treatment – Two dimensional nucleation theory – Surface diffusion of growth theory – KSV Theory– Methods of Finding Growth rate – BCF Theory of Crystal Growth

UNIT 2: Crystal Growth Experimental Techniques

Growth from Melt: Bridgman Method – Kyropolous Method – Czochralski Method – Verneuil Method – Zone Melting Method. **Growth From Vapor:** Physical Vapor Deposition - Chemical Vapor Transport- Open and Closed System - Physical, thermo-chemical factors affecting growth process. **Growth from Solutions:** Solubility - Preparation of Solution - Saturation and Super Saturation - Measurement and Expression of Super Saturation - Slow Coating Method.

UNIT – 3: Thin Film Preparation Methods

Thermal evaporation – General Considerations – Evaporation Methods – Sputtering – Sputtering Process – Sputtering Variants – Chemical Methods – Electrode less deposition – Basics of Thin Film Growth.

UNIT - 4: Thickness Measurements and Applications

Electrical Methods – Microbalance Monitors – Mechanical Methods – Radiation Absorption and Radiation Emission Methods – Optical Interference Methods.

Thin Film Optical devices – Antireflection Coating – Interference filters – Thin Film Resistors and Capacitors – Tribological Coating

UNIT – 5: Plasma Physics

Plasma state - Occurrence in nature – Definition of Plasma – Concept of temperature – Debye Shielding – The Plasma parameters – Criteria for Plasma – Classification of Plasmas - Thermal and Non-thermal Plasmas – Applications of Plasma physics (Basic) - Magnetohydrodynamic generator (MHD) – Basic theory of MHD – Principle of working– Plasma diode.

Text Books:

1. K. Sangwal- ElemenStary Crystal Growth, Saan Pub. UK,1994
2. B.R. Pumplin- Progress in Crystal Growth Characterization Program on press Ltd.UK,1982
3. L.I. Maissel and R. Glang-Hand Book of Thin film Technology, Mc Graw Hill Pub.,1970.
4. A. Goswami-Thin Film Techniques, New Age International Pvt Ltd Publishers (December 1, 2008)
5. Nocholas A Krail and Alvin W Trivelpiece – Principles of plasma physics (McGraw Hillkogkusha Ltd).

Reference Books:

1. K.L. Chopra-Thin Film Phenomena,Mc Graw Hill Pub.
2. P. Santhana Ragavan & P. Ramasamy -Crystal Growth and Process, KRV Pub. Kumbakonam, 2000.
3. Plasma physics- plasma state of matter – S.N.Sen, Pragati Prakashan, meerut .

18PPY2EB	**ELECTIVE-II FUNDAMENTALS OF ELECTRICAL CIRCUITS**	SEMESTER II

Total Credits: 4
Hours per Week: 4

Preamble

To enable students to learn and apply various network techniques and its applications.

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Recall on the basic concepts such as potential difference, specific resistance	K2
CO2	Demonstrate kirchoff's Law, Resistance in parallel, series and grouping of cells.	K3
CO3	Apply various network techniques such as Norton's Theorem, Nodal analysis, Superposition theorem, Thevenin's theorem for the circuit analysis.	K4
CO4	Explain D.C.Motor , its principle and working and also discuss characteristics of shunt motor, series motor, compound motor ,cumulative compound motors	K2
CO5	Outline on AC fundamentals and AC. circuit containing resistance only, furse inductance only, capacitance only.	K3

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	M	S
CO4	M	S	S	S	S
CO5	S	M	S	S	S

S-Strong; M-Medium; L-Low

18PPY2EB	**ELECTIVE - II** **FUNDAMENTALS OF ELECTRICAL CIRCUITS**	SEMESTER II

Total Credits: 4

Hours per Week: 4

UNIT 1: Fundamentals of Current electricity

Introduction - Electron theory - Nature of electricity - Free electrons - Electric current - Electric potential - Potential difference - Concept of potential difference –resistance - Specific resistance – Conductance - Effect of temperature on resistance - Temperature co-efficient of resistance - Temperature co-efficient at various temperatures - Ohms law - Electric power - Electrical energy.

UNIT 2: D.C. Circuits

Resistance in series - Resistance in parallel - Series Parallel circuit - internal resistance of supply - Kirchhoff's law - Illustration of Kirchhoff's law-Grouping of cells - Series grouping of cells - Parallel Grouping of cells – Series Parallel Grouping of cells.

UNIT 3: Network Theorems

Introduction - Network terminology - Network theorems and techniques - Maxwell's Mesh current method - Norton's Theorem - Nodal analysis - Superposition theorem - Thevenin's theorem - Maximum power transfer theorem - Delta/Star and Star/Delta transformations.

UNIT 4: D.C. Motors

Introduction - D.C. Motor principle - Working of D.C. Motor - Voltage equation of D.C.Motor - Power equation - Condition for maximum power - Types of D.C.

Motor - Armature torque of D.C. Motor - Shaft torque - Brake horse power - Speed of a D.C. Motor - Speed relations - Speed regulations - Losses in D.C. Motor - Efficiency of D.C. Motor - Power stages - D.C. Motor characteristics- Characteristics of shunt motor - Characteristics of series motor - Compound motors - Characteristics of cumulative compound motors - Comparison of three types of motors - Applications of characteristics —troubles in D,C, Motors.

UNIT 5: A.C. Fundamentals

Introduction - Sinusoidal alternating current and voltage - Generation of alternating current and voltage - Equation of alternating current and voltage - Important a.c terminology-important relations - Different forms of alternating voltage - Values of alternating current and voltage - Average value - Average value of sinusoidal current - Form factor and peak factor - Phase-phase difference - Representation of alternating current and voltage - Phasor representation of alternating voltages and currents - Phasor representation of sinusoidal quantities - Phasor diagram of sine waves of same frequency - Addition of alternating quantities - Subtraction of alternating quantities - Phasor diagram using r.m.s values - A.C circuit-AC. circuit containing resistance only - A.C circuit containing furse inductance only - A.C circuit containing capacitance only.

Text Books

1. Principles of Electrical Engineering and Electronics, V.K. Mehta, S.Chand Publishing.

2. A Text Book of Electrical Technology, Vol.I Basic electrical engineering, B.L. Theraja, & A.K. Theraja, S.Chand Publishing.

3. Basic Electrical Engineering, V.K. Mehta & Rohit Mehta, S.Chand Publishing.

4. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI Publications,2nd edition.

5. Basic Electrical Engineering, Nagsarkar,Sukhija, Oxford Publications,2nd edition.

6. Fundamentals of Electrical Circuits, Charles K. Alexander, Mattew N.O.Saidiku, Tata McGraw Hill company.

Reference Books

1. Circuit Theory (Analysis and Synthesis) - A. Chakrabarti-Dhanpat Rai&Co.

2. Network Theory - Prof. B.N. Yoganarasimham.

3. Circuit Theory - Sudhakar and Shyam Mohan.

18PPY3EA	**ELECTIVE-III** **DIGITAL COMMUNICATION**	SEMESTER III

Total Credits: 4

Hours per Week: 4

Preamble

To enable students to learn and apply basic digital communication, its principle and applications.

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Outline on single band communication systems	K2
CO2	Elaborate phase deviation and modulation index and direct FM and PM modulators	K2
CO3	Discuss the basic digital communication, its principle and applications.	K2
CO4	Recall on the principle of fiber optics, its classification and the losses.	K1
CO5	Explain the basic cellular concepts and the network components used in the cellular communication	K3

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	M	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S-Strong; M-Medium; L-Low

18PPY3EA	**Elective-III** **DIGITAL COMMUNICATION**	SEMESTER III

Total Credits: 4

Hours per Week:4

CONTENTS

UNIT – 1: Single Sideband Communication Systems

Single sideband systems - Mathematical analysis of suppressed carrier AM - Ring and FET push pull balanced modulators - Single side band transmitters and BFO receivers - ISB.

UNIT - 2: Angle Modulation

Angle modulation - Mathematical analysis - Phase deviation and modulation index - Frequency deviation and percent modulation - Deviation ratio - Commercial broadcast band FM - Direct FM and PM modulators using varactor diode - Frequency up conversion – Phase locked loop direct FM transmitter - Armstrong indirect FM transmitter - FM receiver block diagram - FM de modulation using PLL only -limiter circuits - FM vs PM.

UNIT – 3: Digital Modulation, Transmission, Multiplexing

Introduction to digital modulation, ASK, FSK, PSK modulation principle only - High speed Modems - Dual four level converters. Digital transmission - Pulse modulation - PAM-TDM-PWM-PPM-FDMPCM. (Concept only)

UNIT – 4: Baseband transmission and Optimal Reception of Digital Signal

Pulse shaping for optimum transmissions. A Baseband Signal Receiver,

Probability of Error. Optimum Receiver, optimal of Coherent Reception. Signal Space Representation and Probability of Error, eye diagrams, Cross talk.

UNIT – 5: Cellular Telephone Communications

Cellular telephone concepts - Mobile telephone service evolution of cellular telephone - Cellular telephone - Frequency reuse interference - Cell splitting, Sectoring, Segmentation and Dualization cellular system topology - Roaming and handoffs - Cellular telephone network components. Second generation cellular telephone systems – Digital cellular telephone - Global system for mobile communications.

Text Books:

1. Wayne Tomasi, Electronic Communications Systems, (Fundamentals through advanced) Fifth Edition, Pearson Education, Inc 2006.

2. Robert J Schoenbeck - Electronic Communications, Prentice Hall of India, New Delhi, 2002.

3. Principles of communication systems - Herbert Taub. Donald L Schiling, Goutam Sana, 3rd Edition,McGraw-Hill, 2008.

4. Digital and Analog Communicator Systems - Sam Shanmugam, John Wiley, 2005.

Reference Books:

1. Digital Communications - John G. Proakis . Masoud salehi – 5th Edition, McGraw-Hill, 2008.

2. Digital Communication - Simon Haykin, Jon Wiley, 2005.

3. Digital Communications - Ian A. Glover, Peter M. Grant, Edition, Pearson Edu., 2008.

4. Communication Systems - B.P. Lathi, BS Publication, 2006

18PPY3EB	**ELECTIVE-III** **ASTROPHYSICS**	SEMESTER III

Total Credits: 4

Hours per Week: 4

Preamble

To enable students to learn and apply the basic concept of astronomical instruments and its working

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Understand basic astronomical instruments and its working	K2
CO2	Recall of Solar systems and the other members of solar systems	K2
CO3	Explain birth and death of variable stars , binary stars	K3
CO4	Outline on the stars and the measurement of stellar distance	K3
CO5	Learn theories of universe, galaxies and star clusters	K4

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	S	S	S	S
CO3	S	S	M	M	S
CO4	S	S	S	S	S
CO5	S	S	S	S	M

S-Strong; M-Medium; L-Low

18PPY3EB	**ELECTIVE-III** **ASTROPHYSICS**	SEMESTER III

Total Credits: 4

Hours per Week: 4

CONTENTS

UNIT-1:Astronomical instruments

Optical telescope - reflecting telescope - types of reflecting telescope - advantages of reflecting telescope - Radio telescopes - astronomical spectrographs - photographic photometry - photo electric photometry - detectors and image processing.

UNIT-2:Solar system

The sun-physical and orbital data - Photosphere - Chromosphere - corona - solar prominences - sunspot - sunspot cycle - theory of sunspots - solar flare - mass of the sun - solar constant - temperature of the sun - source of solar energy - solar wind. Other members of the solar system - Mercury - Venus - Earth - Mars - Jupiter - Saturn - Uranus - Neptune - Pluto - Moon - Bode's law - Asteroids - comets - Meteors.

UNIT-3: Stellar Evolution, Binary and variable stars

Birth of a star - Death of a star - Chandrasekhar limit - white dwarfs - Neutron stars - black holes - Quasars - Nebulae - Supernovae

Binary stars - Origin of Binary stars- Variable stars - Cepheid variables - RV Tauri variables - long period variables - irregular variables - flare stars.

UNIT-4: Magnitudes, distance and spectral classification of stars

Magnitude and brightness - apparent magnitude of stars - absolute magnetic of stars - relation between apparent magnitude and absolute magnitude of stars - Luminosities of stars - measurement of stellar distance - Geometrical parallax method - distance from red shift measurement - Harvard system of spectral classification .

UNIT-5: Theories of the universe, galaxies and star clusters

Origin of the universe - the big bang theory - the steady state theory - the oscillating universe theory - Hubble's law.

Galaxies - types of galaxies - Milky Way - star clusters - open clusters - globular clusters.

TEXT BOOKS:

1. *Krishnasamy, K.S.* 2002. **Astro Physics – A Modern Perspective**. New Age International Pvt Ltd, New Delhi.
2. *Murugesan, R.* 2003. **Modern Physics**, [11th Edition] S Chand & Company Ltd, New Delhi.

REFERENCE BOOKS:

1. *Baidyanath Basu*, 2001. **An Introduction to Astro physics**, 2nd printing, Prentice Hall of India Private limited, New Delhi.
2. *Kumaravelu*, *S.* 1993. **Astronomy**, Janki calendar corporation, Sivakasi.
3. *Baker and Fredrick*, 1964**. Astronomy.** [9th Edition] Van No strand Rein hold Co, New York.
4. **Illustrated World of Science Encyclopedia** - Vol I and Vol VIII - Creative world publication - Chicago.

18PPYSS1	**SELF STUDY PAPER-I** **ENVIRONMENTAL PHYSICS**	SEMESTER III

Total Credits: 1

CONTENTS

Unit 1: Essentials of Environmental Physics

Structure and thermodynamics of the atmosphere – Composition of air – Greenhouse effect – Transport of matter – Energy and momentum in nature – Stratification and stability of atmosphere – Laws of motion – Hydrostatic equilibrium .

Unit 2: RADAR and Remote Sensing

Introduction to Remote Sensing - Physics of Remote Sensing - Applications of remote sensing in pollution monitoring - RADAR and LIDAR - Principles and applications.

Unit 3: Global and Regional Climate

Elements of weather and climate - Horizontal motion of air – Pressure gradient forces – Viscous forces – Inertia forces – Vertical and horizontal motion of water – Energy balance – a zero-dimensional Greenhouse model – Global climate models - Enhanced greenhouse effect**.**

Unit 4: Energy Sources

Energy sources - Solar energy - Wind energy - Bioenergy - Hydropower and forestry

Unit 5: Environmental pollution and Degradation

Elementary fluid dynamics – Diffusion – Turbulence and turbulent diffusion – Factors governing air, water and noise pollution – Air and water quality standards – Waste disposal – Heat island effect – Land and sea breeze – Puffs and Plumes – Gaseous and particulate matters – Wet and dry deposition.

Text Books:

1. Egbert Boeker & Rienk Van Groundelle -Environmental Physics - John Wiley- 2nd edition (2011)
2. Clare Smith – Environmental Physics – Routledge; 1st edition (2001)
3. Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, Wiley- 6th edition (2007)
4. W.G. Rees - Physical Principles of Remote Sensing, Cambridge University Press- 3rd edition (2013)
5. J.T. Hougton -The Physics of Atmosphere – Cambridge university press (1977)
6. R.N. Keshavamurthy and M. Shankar Rao – The physics of Monsoons – South Asia Books(1992)

Reference Books:

1. J. Twidell and J. Weir –Renewable energy resources – 3rd Revised edition-Routledge (2015)
2. G.J. Haltiner and R.T. Williams – Numerical Weather Prediction – John Wiley (1980).

18PPYSS2	**SELF STUDY PAPER – II: ELECTRICAL AND ELECTRONIC APPLIANCES**	**SEMESTER: III**

Total credits:1

CONTENTS

Unit I:

Test and Measurement

Digital calipers – Digital screw gauge – Digital balance – Digital clock – Digital thermometer – Digital multimeters – Digital oscilloscopes.

Unit II

Home appliances

Air conditioner – Refrigerator – Microwave oven – Induction cooker – Washing machines – Inverters – Solar powered appliances – Digital cameras.

Unit III

Communication

Fibre optics – Cellular phones – Cellular phone jammers – Bluetooth – WiFi – LiFi - Global positioning system – RFID security systems.

Unit IV

Robotics

Basics – Robotic arm – Mobile robots – Autonomous robots - Honda's ASIMO robot.

Unit V

Computers

Basic components – Motherboards – Memory – I/O devices – Assembling – operating systems.

BOOKS FOR STUDY:

1. *GottapuSasibhushana Rao*, 2012. **Mobile Cellular Communication**, [1st Edition], Pearson.

2. *S K Saha,* 2008. **Introduction to Robotics**, [1st Edition], Tata McGraw-Hill Education.

3. *Alok Kumar*, 2008. **Computer General Awareness** [1st Edition], UpkarPrakashan.

18PPY4EA	**ELECTIVE-IV** **RENEWABLE ENERGY SOURCES**	SEMESTER IV

Total Credits: 4

Hours per Week: 5

Preamble

To enable the students to learn various types of energy sources.

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Simplify the types of wind energy systems and its merits	K2
CO2	Discuss non- conventional energy sources from ocean	K3
CO3	Explain bio gas and the generation of bio gas.	K3
CO4	Understand thermal energy their laws and types of pyroheliometers	K4
CO5	Outline on solar energy and their applications.	K5

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	M	S	S	S	S
CO3	S	S	S	M	S
CO4	S	M	S	S	S
CO5	S	S	M	S	S

S-Strong; M-Medium; L-Low

18PPY4EA	**ELECTIVE- IV RENEWABLE ENERGY SOURCES**	**SEMESTER-IV**

Total credits: 4

Hours per Week: 5

CONTENTS

UNIT-I: Wind Energy

Power in the wind – Types of wind energy systems –Horizontal axis wind Turbine – Vertical axis wind Turbine- Merits and Demerits.

UNIT – II: Ocean Energy

Tidal Energy – Ocean Thermal Energy Conversion (OTEC) – Closed Cycle OTEC system – Open Cycle OTEC System.

UNIT – III: Biomass and Biogas

Energy from biomass, biomass conversion technologies - wet and dry process - photosynthesis biogas generation: introduction – basic processes and energetic - advantages of anaerobic digestion-factors affecting bio-digestion and generation of gas.

UNIT – IV: Thermal Energy

Definition of Total thermal Energy density - Spectral Energy density – Spectral Emissive power – Emissivity – Emissive power – Absorptive power – Reflective power – Kirchhoff's Law of radiation and its proof – verification of Kirchhoff's Results: Ritche's Experiment. Distribution of Energy in the thermal spectrum – Lummer and Pringsheim Experiment and its Results – Wien's Displacement Law and Radiation Law – Rayleigh Jean's Law Planck's Radiation Law – Deduction of Wien's Law and Rayleigh – Jean's Law from Planck's law.

UNIT – V: Solar Energy

Solar radiation – Solar radiation outside the earth's atmosphere Solar radiation at the earth's surface – Solar Thermal Energy – Solar Thermal devices and systems: Solar water heater – Sub components of solar water heater – Solar Cooker and its merits and demerits. Solar constant – Temperature of sun – Disappearing filament optical Pyrometer - Pyroheliometers: Angstrom Pyroheliometer – Water flow Pyroheliometer.

TEXT BOOKS:

1. *Rai G.D.* 2004. **Solar Energy Utilization.** Khanna Publishers, New Delhi.
2. *Brij Lal and Subrahmanyam N.* 2010. **Heat and Thermodynamics**. S Chand and Co, New Delhi
3. *MaheshwarDayal*. 1991. **Renewable Energy Environment and Development.** Konark Publication, New Delhi
4. *Suhatme S.P. and Nayak J. K.* 2009. **Solar Energy.** [3rd Edition], Tata McGraw Hill Publishing Company Ltd, New York

18PPY4EB	**ELECTIVE-IV MATERIALS SCIENCE**	SEMESTER IV

Total Credits: 4

Hours per Week: 5

Preamble

To enable students to learn properties of magnetic materials, behaviors of Polymers and dielectrics.

Course Outcomes

On the successful completion of the programme, students will able to

CO Number	CO Statement	Knowledge Level
CO1	Understand ceramics and its applications	K2
CO2	Recall on the behaviors of polymers, its structure and applications.	K3
CO3	Summarize properties of Dielectrics, its classification and their applications.	K2
CO4	Explain properties of magnetic materials and dielectric materials with their domain structure	K2
CO5	Outline on composites materials.	K4

Mapping with Programme Outcomes

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	M	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S-Strong; M-Medium; L-Low

18PPY4EB	**ELECTIVE-IV** **MATERIALS SCIENCE**	SEMESTER IV

Total Credits: 4

Hours per Week: 5

CONTENTS

Unit - I: Ceramics

Structural features – Production techniques – Traditional and Engineering ceramics - Alumina - Silicon nitride - Silicon carbide - Zirconia - Electrical properties - Mechanical properties - Thermal properties.

Composites

Definition – Fiber reinforced-plastic composite materials - production techniques - Metal-matrix and ceramic-matrix composites - commercial composites.

Unit - II: Polymers

Introduction - polymerization reactions - industrial polymerization methods - processing of plastic materials - thermoplastics - thermosetting plastics - Elastomers (rubbers) structures - properties - applications - deformation and strengthening of plastic materials - creep and fracture of polymeric materials.

Unit -III: Dielectrics

Electrical polarization – Mechanisms of polarization- electronic, ionic, dipolar and space-charge polarization – Clausius-Mossotti relation - Some dielectric materials – Piezoelectric materials – Pyroelectric and ferroelectric materials – Applications of these materials.

Unit -IV: Magnetic Materials

Classification of magnetism **–** Effects of 3d and 4f transition elements in magnetism - Soft magnetic materials: Iron based alloys, Ni_Zn and Mn_Zn ferrites – Microwave ferrites and garnets – Hard magnetic materials: AlNiCo alloys – Barium ferrite, Samarium-Cobalt, Platinum-cobalt, Neodymium- Iron-

Boron - Applications of hard and soft magnets - Materials used for magnetic recording media - Read and Write head- Magneto optics basics - Kerr effect – Faraday Effect - Magneto optic recording.

Unit -V: Magnetic properties of solids

Diamagnetism- Langevin equation- Quantum theory of paramagnetism- Curie law- Hund's rules- Paramagnetism in rare earth and iron group ions- Elementary idea of crystal field effects- Ferromagnetism- Curie-Weiss law- Heisenberg exchange interaction- Mean field theory- Antiferromagnetism- Neel point- Other kinds of magnetic order- Nuclear magnetic resonance.

Text Books:

1. William F. Smith, Principles of Materials Science and Engineering, McGraw-Hill Inc.,US- 3rd Revised edition edition (1995)
2. V. Raghavan, Materials Science and Engineering, PHI Learning Private Limited-New Delhi; 6th Revised edition (2015)
3. J.C. Anderson, K.D. Leaver, R.D. Rawlings and J.M. Alexander, Materials science, Springer; 4th ed. (1990)
4. David Jiles, Introduction to Magnetism and Magnetic Materials, Nelson Thornes Ltd- 2nd Revised edition edition (1998)
5. Nicola. A.Spaldin, Magnetic Materials: Fundamentals and Applications, Cambridge University Press- 2 edition (2010)

Reference Books:

1. G.K. Narula, K.S. Narula and V.K. Gupta, Materials Science - Tata McGraw-Hill Education (1989)
2. E.P. Wohlfarth Ferromagnetic materials, Vols. 1, 2 &3 - North-Holland-2nd edition (1982)
3. H. Ibach and H.Luth, Solid State Physics – An Introduction to Principles of Material Science, 4th Ed. -Springer Science & Business Media (2009)
4. C.M. Srivastava and C. Srinivasan Science of Engineering Materials, Wiley – Eastern Ltd., New Delhi (1987)
5. J. P. Srivastava: Elements of solid state physics (Prentice Hall India; 2nd edition).