DEPARTMENT OF PHYSICS

PRIST UNIVERSITY

Declared Under Section 3 of UGC Act, 2056

Thanjavur, Tamilnadu, India

M.Sc., PHYSICS

REGULATION - 2020

SYLLABUS UNDER RESEARCH INTEGRATED CURRICULUM

PRIST
DEEMED TO BE
UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMIL NADU

M.Sc., PHYSICS -SYLLABUS – REGULATION 2020

COURSE STRUCTURE

Course Code	Course Title	L	T	P	C
	SEMESTER I				
20213AEC11	Advanced Mathematical Physics	6	1	0	5
20213AEC12	Classical and Statistical Mechanics	6	1	0	5
20213AEC13	Electronics and Communication	6	1	0	4
20213SEC14L	Spectroscopy and General Electronics Lab	0	0	4	2
20213DSC15_	Discipline Specific Elective – I	5	0	0	4
20213RLC16	Research Led seminar	-	-	-	1
	Total	**23**	**3**	**4**	**21**
	SEMESTER II				
20213AEC21	Microprocessor and Microcontroller	5	1	0	5
20213AEC22	Quantum Mechanics	5	1	0	5
20213AEC23	Condensed Matter Physics	5	0	0	4
20213SEC24L	Advanced General Experiments Lab	0	0	4	2
20213DSC25_	Discipline Specific Elective – II	5	0	0	4
20213RMC26	Research Methodology	3	0	0	2
20213BRC27	Participation in Bounded Research	-	-	-	2
	Total	**23**	**2**	**4**	**24**
	SEMESTER III				
20213AEC31	Electro Magnetic Theory	6	1	0	6
20213AEC32	Nuclear and Particle Physics	6	1	0	6
20213SEC33L	Advanced Electronics Lab	0	0	5	3
20213DSC34_	Discipline Specific Elective – III	5	0	0	4
202__OEC35_	Open Elective	4	0	0	3
20213SRC36	Participation in Scaffold Research (Societal Project)	-	-	-	2
	Total	**21**	**2**	**5**	**24**
	SEMESTER IV				
20213AEC41	Laser Physics And Non Linear Optics	6	1	0	6
20213AEC42	Numerical Methods and Computational Physics	6	1	0	6
20213SEC43L	Numerical Methods Lab with C++ Programming	0	0	5	3
20213DSC44_	Discipline Specific Elective – IV	5	0	0	4
20213PRW45	Project Work	0	0	0	6
20213PEE	Programme Exit Examination	-	-	-	2
	Total	**17**	**2**	**5**	**27**
	Total Credits for the Programme				**96**

Discipline specific Electives

Semester	Discipline specific Elective Courses- I
I	a)20213DSC15A-Instrumentation b)20213DSC15B-Crystal Growth Processes

Semester	Discipline specific Elective Courses -II
II	a)20213 DSC25A- Atomic and MolecularPhysicsb)20213DSC25B- Radiation Physics

Semester	Discipline specific Elective Courses -III
III	a)20213 DSC34A-Non-Conventional Energy Physics b)20213 DSC34B-Photonics Devices and Applications

Semester	Discipline specific Elective Courses -IV
IV	a)20213 DSC43A-Nano Science and Technology b)20213 DSC43B-Non-linear Dynamics

OPEN ELECTIVE COURSE

Semester	General Elective Courses
III	a) 202ENOEC-Writing for the Media b) 202MAOEC-Applicable Mathematics Techniques c) 202CHOEC- Green Chemistry d) 202BCOEC-Herbal Medicine e) 202CSOEC-M-Marketing f) 202CMOEC- Financial Services g) 20280OEC – Counselling and Psychology

Credit Distribution:

Sem	AEC	SEC	DSC	OEC	Research	Others	Total
I	14	2	4	-	1	-	21
II	14	2	4	-	4	-	24
III	12	3	4	3	2	-	24
IV	12	3	4	-	6	2	27
Total	52	10	16	3	13	2	96

Course Code	CORE PAPER – I ADVANCED MATHEMATICAL PHYSICS	L	T	P	C
20213AEC11		6	1	0	5

Aim:

• To learn various mathematical concepts and techniques in vector space, groups and functions of special types to solve physical problems

UNIT – I: MATRIX THEORY

Definitions of basic matrix theory – Rank of matrix – Inverse matrix – characteristic matrix and characteristic equation of a matrix – Cayley –Hamilton theory – characteristic root and vectors of a matrix [eigen values & eigen vectors] – Diagonalization of matrices.

VECTOR FIELDS:

Line, surface and volume integrals – Divergence of vector function – curl of vector function – Gauss divergence theorem – stokes theorem – Green's theorem – Orthogonal curvilinear coordinate systems: Expression for gradient, divergence, curl and Laplacian.

UNIT – II: COMPLEX ANALYSIS

Functions at Complex Variables- Differentiability – Cauchy – Riemann Conditions – Complex Integration – Cauchy's Integral Theorem and Integral Formula – Taylor's and Laurent's series – Residues and Singularities – Cauchy Residue Theorem – Evaluation of Definite Integrals.

UNIT – III

Fourier Series – Sine and Cosine Half Range Series – Fourier Transformations – Sine and Cosine Transforms – Faltung Theorem- Application to Heat and Wave Equation.

Laplace Transform – Convolution Theorem – Solution of Ordinary Equations.

UNIT – IV

Gamma and Beta Functions – Series Solution – Legendre, Bessel, Laguerre and Hermite Differential Equations – Rodriguez Formula – Generating Functions – Orthogonality Relations – Important Recurrence Relations.

UNIT - V: NUMERICAL METHODS

Principals of Least Square – Curve Fitting – Parabola- Exponential – Solutions of Numerical Algebraic and Transcendental Equations – Newton Raphson Method – solution of simultaneous Linear Algebraic Equations – Gauss Elimination Method – Numerical Integration – Trapezoidal Rule, Simpson's

1/3 Rule- Solution of Ordinary Differential Equations – Euler's Method – Second Order and fourth order Runge-Kutta Method.

Books for Study and Reference:

1. E. Kreyszig, Advanced Engineering Mathematics. (Wiley Eastern, New Delhi, 2083)
2. G. Arfken and H.J. Weber, Mathematical Methods of Physics.
3. A.K. Ghatak, I.C. Goyal and A.J. Chua, Mathematical physics.
4. W.W. Bell, Special Functions for Scientists and Engineers.
5. Transforms – Goyal Gupta.
6. Numerical methods for scientist and engineers – M.K. Venkatraman.
7. Mathematical Physics – B.D. Gupta.

Course Code	CORE PAPER – II CLASSICAL AND STATISTICAL MECHANICS	L	T	P	C
20213AEC12		6	1	0	5

Aim:

- To learn various mathematical techniques of classical mechanics and their applications to physical systems and introduce relativistic dynamics.

UNIT – I: FUNDAMENTAL PRINCIPLES AND LAGRANGIAN FORMULATION

Constraints - Generalized Co-ordinates – D'Alembert's Principle and Lagrange' Equation – Hamilton Formulation – Lagrange's Equation of Motion.

LAGRANGIAN FORMULATIONS – APPLICATIONS:

Theory of Small Oscillations – Normal Modes – Wave Motion – Wave Equation. Euler Angles – Eular's Equations – Linear Tri Atomic Molecule.

UNIT – II: HAMILTON'S FORMULATION

Hamilton's Canonical Equation of Motion – Hamilton's Equation from Variation Principle – Principle of Least Action Poisson Brackets – Invariance of PB Under canonical Transformation Method – Action Angle Variable.

UNIT –III: NON – LINEAR DYNAMICS

Regular and Chaotic Motions – Linear and Non-Linear Forces – Dissipative and Conservative Systems – Discrete and Continues Time Dynamical System – Logistic Map – Fixed Point Analysis – Period Doubling Phenomena – Route to Chaos – Characterization of Chaos – Dynamic of MLC Circuits.

SOLUTION: Linear and Non – Linear Waves – Solitary – Kdv Equation.

UNIT – IV: CLASSICAL STATISTICAL MECHANICS

Macro and Micro States – Statistical Equilibrium – Phase Space and Ensembles – Density Function – Liouville's Theorem – Maxwell – Boltzmann Distribution Laws – Micro Canonical Ensembles – Ideal Gas Entropy – Partition Function – Principle of Equipartition of Energy - Canonical and Grand Canonical Ensembles.

UNIT – V: QUANTUM STATISTICAL MECHANICS

Basic Concepts – Quantum Ideal Gas – Bose Einstien and Fermi Dirac Statistics – Distribution Laws – Sackur – Tertrode Equation – Equation of State – Bose Einstein Condensation.

Ideal Bose Gas – Black Body and Plank's Radiation – Phonons – Liquid Helium – Degeneracy – Fermi Gas – Pauli's Para Magnetism.

References:

1. Classical Mechanics – Golstien
2. Classical Mechanics – Gupta Kumar

Course Code	CORE PAPER – III ELECTRONICS AND COMMUNICATIONS	L	T	P	C
20213AEC13		6	1	0	4

Aim:

• To understand the working of advanced semiconductor devices and digital circuits and the utility of OP-AMP and learn the basics of integrated circuit fabrication, applications of timer IC-555 and building block of digital systems.

UNIT – I: OPTO ELECTRONICS

LED – applications – Photo emissive devices – Photomultiplier tube – photovoltaic devices – Bulk type photoconductive cell – Photodiodes – Phototransistor – LCD – applications.

POWER ELECTRONICS

TRIAC – construction – operation – characteristics – application – DIAC – application – Unijunction transistor (UJT) – equivalent circuit – application.

UNIT – II: TELEVISION FUNDAMENTALS

Introduction to Antenna – Current and voltage Distribution – UHF Antenna – Horn Antenna – Wide Band Antenna – Log Periodic Type – Loop Antenna.

Essential of Colour T.V.: Colour perception – Three colour theory – Luminance, Hue and Saturation – Colour T.V. camera – Luminance signal – colour T.V. display tubes – Delta-gun – Gun-in-line – trintron colour picture tube – NTSC colour T.V. system – PAL colour T.V. system.

UNIT – III: COMMUNICATION SYSTEMS

Pulse Modulation – Time Division Multiplexing – Pulse Time Modulation – Pulse width Modulation – Pulse code Modulation – Basic Digital Communication System – Amplitude Shift Keying – Phase Shift keying and Frequency Shift Keying.

UNIT – IV: FIBER OPTIC COMMUNICATION

Basic Optical Laws and Definitions – Optic Fiber Modes and Configurations- Wave equation for Step Index Fiber – Graded Index Fiber Structure – Fiber materials – Fiber Fabrications – Double Crucible Method – Attenuation – Lensing Schemes for Coupling – Fiber to Fiber Joints – Optical Fiber Connectors- Optical Source – LED, Laser Diode – Photo Detectors – Noise Detector Responding Time.

UNIT – V: SATELLITE COMMUNICATION

Introduction Satellite Communication System – Satellite orbits – Basic Components of Satellite Communication – Constructional Features – Commonly used Frequencies – Communication Package Communication in India. ISDN, LAN, VAN.

Books for Study and Reference:

1. Principals of Communication Engineering – Anokh Singh, A.K. Chabra, S. Chand.
2. Electronic Communication System – Kenndy and Davis, Tata McGraw Hill Edition.
3. Optical Fiber Communications – Gerd Keiser, McGraw Hill International Editions.
4. Basic electronics solid state – B.L. Theraja, S. Chand & co.
5. Principals of Electronics – V.K. Metha, Rohit Metha, S. Chand & co Ltd.
6. Monochrome and colour television – R.R. Gultai, New Age International (P) Ltd Publishers, New Delhi.

Course Code	CORE PRACTICAL –I SPECTROSCOPY AND GENERAL ELECTRONICS LAB	L	T	P	C
20213SEC14L		0	0	4	2

Aim:

- Experimental determination of certain physical constants and its properties.
- Experimental verification of characteristics and applications of electronic components with devices.

SECTION A

1. Determination of q, n, σ by elliptical fringes method.
2. Determination of q, n, σ by hyperbolic fringes method.
3. Determination of Stefan's Constant.
4. Determination of dielectric constant at a high frequency by Lecher wire.
5. Determination of e/m of an electron by Thomson's method.
6. Iron Arc spectrum.
7. Copper Arc spectrum.
8. Brass Arc spectrum.

SECTION B

1. Feed back amplifier.
2. Characteristics of JFET.
3. Characteristics of UJT.
4. Characteristics of SCR.
5. Characteristics of LDR.
6. Common sources amplifier using FET.
7. Design and study of Bistable multivibrator using 555 timer.
8. Opamp CMRR, inverting and non inverting amplifiers.

Course Code	DISCIPLINE SPECIFIC ELECTIVE COURSE-I INSTRUMENTATION	L	T	P	C
20213DSC15A		5	0	0	4

Aim:

- To understand the concepts and application of electronic Instrumentation in the Medical field.

UNIT I: DISPLACEMENT MEASUREMENT

Electrical Method – The Strain Gauge – The LVDT – Capacitance Gauges – Piezoelectric Material – Piezo Electrical Transducers.

UNIT II: PRESSURE MEASUREMENT

Manometers – Elastic Types – Bourdon Tubes – Diaphragm Elements – Bellows Elements – Electrical Transducers as Secondary Transducers – Resistive Transducers – Inductive Transducers – Measurements of Low Pressure (Vacuum gauges) - Thermo Couple Vacuum Gauge – Pirani Gauges.

UNIT III: TEMPERATURE MEASUREMENT

Resistance Thermometers – Bi Metallic Thermometers - Radiation Pyrometers – Radiation Receiving Elements – Total Radiation Pyrometers – Infra-red Pyrometers – Optical Pyrometers – Measurements of Very High or Steller Temperature.

UNIT IV: FLOW MEASURENT

Flow Rate Sensing Elements – Measurement of Flow – Turbine Meters – Electromagnetic Flow Meters - Hot Wire Anemometers – Flow Meter Using Thermistors – Ultrasonic Flow Transducers.

UNIT V: MEASUREMNT OF LEVEL , THICKNESS AND HUMIDITY

Electrical Methods – Resistive Method – Inductive Methods – Capacitive Methods – Measurement of Liquid Level with Gamma Rays – Liquid Level Measurement Using Float. Measurement of Thickness: Inductive Methods – Ultrasonic Vibration Methods – Measurement of Humidity.

Book for Study:

1. A Course in Electrical and Electronic Measurement and Instrumentation – A.K. Sawhney

Course Code	DISCIPLINE SPECIFIC ELECTIVE COURSE-I	L	T	P	C
20213DSC15B	CRYSTAL GROWTH PROCESSES	5	0	0	4

AIM:

To introduce the knowledge on crystal growth and characterization.

OBJECTIVE:

To expose the students with theories of nucleation• & crystal growth, crystal growth by from solution, melt and vapour phase and their characterization.

Unit – 1: Crystal growth theory

Classical theory of nucleation: Gibbs Thomson equation for vapour and solution – Modified Thomson's Equation for melt – Spherical nucleus – Cylindrical nucleus - Heterogeneous nucleation – cap-shaped nucleus – disc shaped nucleus – Kinetics of crystal growth – Kossel, Stranski, Volmer (KSV) theory – Burton, Cabrera and Frank (BCF) theory.

Unit – 2:Solution growth

Low temperature solution growth – Expression of supersaturation – Methods of crystallization – Constant temperature bath – Nonlinear phenomena in KDP family crystals – High temperature solution growth – Principles of Flux growth.

Unit – 3: Gel growth

Growth from gel: structure and properties of gel – single diffusion method – Double diffusion method.

Unit – 4: Melt growth

Growth from melt: Bridgmann and related technique – Crystal pulling technique – Liquid encapsulated Czochralski technique – Zone melting technique – Skull melting process – Verneuil process.

Unit – 5: Vapour Growth

Physical vapour deposition – Chemical vapour transport – hydrothermal growth – low pressure autoclaves - high pressure autoclaves – growth of zinc oxides – growth of garnets Electrocrystalization – electro chemical potential – Nernst relation – Voltametry.

References:

1. Crystal Growth processes and methods – P.Ramasamy, P.

   Santhanaraghavan, KRU Publication.

2. J.C. Brice, The growth of crystals from liquid (North Holland Publishing Co., Amsterdom).

Course Code	CORE PAPER – IV MICROPROCESSOR AND MICROCONTROLLER	L	T	P	C
20213AEC21		5	1	0	5

Aim:

- To learn basic principles of architecture and functioning of microprocessor and microcontroller and programming and interfacing aspects of them.

UNIT – I: MICROPROCESSOR 8085

8085 Microprocessor – Bus Architecture – registers – Central processing unit – timing and control unit – Instruction and Data flow – System timings – Examples – Instruction set – Data transfer group – Logical group – Branch group – Stack and I/O control instructions – Addressing modes.

UNIT – II: ASSEMBLY LANGUAGE PROGRAMS (8085 ONLY)

Addition – Subtraction – Multiplication – Division – BCD arithmetic – Searching an array for a given number – Choosing the biggest and smallest numbers from a list – Ascending and Descending order – Square root of a number – Time Delay – Square wave generator.

UNIT – III: MICROPROCESSOR 8086

Organization of the 8086 Microprocessor – Memory organization – Register structure – Addressing modes in 8086 – Minimum mode and maximum mode – Exception handling in 4086 – Assembler and Multiprocessing – Assembler – Directives and operators – Data definition and storage allocation – Assigning names and expressions – Segment definition – Program definition – Alignment directives.

UNIT – IV: INTERFACING MEMORY AND I/O DEVICES

Interfacing memory and devices – I/O and memory mapped I/O – Types of interfacing devices – Data transfer schemes – Programmed and DMA data transfer schemes – Programmable Peripheral Interface (8255 A) – 8253 Timer Interface – DMA controller – Programmable Interrupt Controller (8259) – Programmable communication interface (8251).

UNIT – V: MICROCONTROLLER 8051

Introduction of Microprocessor and Micro controllers – Comparison of microprocessor and microcontrollers – 8051 architecture – Internal memory – Input output pins, ports external memory – Addressing modes.

Instruction set of 8051 – Data transfer instruction – Arithmetic instruction – Branch instruction – Bit manipulation instruction.

Books for Study and Reference:

1. R. Goankar, Microprocessor Architecture, programming and applications (Wiley Eastern).
2. B. Ram, Fundamentals of Microprocessor and Microcomputers (Dhanapet Rai & Sons).
3. Introduction to Microprocessor – Aditya P. Mathur.
4. Microcomputer System 8086/8088 Family – Yuchngliv and clenn A Gibson Prentice Hall.
5. Microprocessors and Interfacing – Programming and Hardware Douglas V Hall.
6. The 8051 Microcontroller Architecture, Programming & Applications – Kenneth J. Ayla, Penram International Publishing (India).

Course Code	CORE PAPER – V QUANTUM MECHANICS	L	T	P	C
20213AEC22		5	1	0	5

Aim:

- To learn the fundamental concepts and certain theoretical methods of quantum mechanics and their applications to microscopic systems.

UNIT I: SCHRODINGER EQUATION AND GENERAL FORMULATION

Schrodinger Equation – Physical Meaning and Condition on the Wave Function – Expectation Values and Ehrenfest's Theorem – Hermitian Operators and their Properties – Commutation Relation Uncertainty Relation – Bra and Ket Vectors – Schrodinger, Heisenberg and Interaction Pictures.

UNIT II: EXACTLY SOLVABLE SYSTEM

Liner Harmonic Oscillator – Solving the one Dimensional Schrodinger Equation – Abstract Operator Method – Particle in a Box-Square Well Potential – Rectangular Barrier Potential – Rigid Rotator – Hydrogen Atom.

UNIT III: APPROXIMATION METHODS

Time Independent Perturbation Theory: Non-degenerate and Degenerate Perturbation Theories – Stark Effect – WKB Approximation – Application to Tunneling Problem and Quantization Rules.

Time Dependent Perturbation Theory: Harmonic Perturbation – Transition Probability.

UNIT IV: SCATTERING THEORY

Scattering Cross Section – Born Approximation – Partial Wave Analysis.

Angular Momentum: Matrix Representation of J-Spin Angular Momentum – Eigen Values – Addition of Angular Momenta – Clebsch –Gordan Coefficients (Basics Idea only).

UNIT V: RELATIVISTIC QUANTUM MECHANICS

Klien-Gordan Equation for a Free Particle and in Electromagnetic Filed – Dirac Equation for a Free Particle. Charge and Current Densities – Dirac Matrices – Plane Wave Solution – Negative Energy States – Spin Angular Momentum – Spin-Orbit Coupling.

Books for Study:

1. Quantum Mechanics by L.Schiff - Tata McGraw Hill.
2. A Text Book of Quantum Mechanics by P.M.Mathews and K.Venkatesan - Wiley Eastern.
3. Quantum Mechanics by V.K.Thankappan – Wiley Eastern.
4. Quantum Mechanics by A.Goswamy

Course Code	CORE PAPER – VI CONDENSED MATTER PHYSICS	L	T	P	C
20213AEC23		5	0	0	4

Aim:

- To learn the basics of crystal structure and underlying theoretical development for the description of certain properties and phenomena of solid states.

UNIT – I: CRYSTAL STRUCTURE

Crystal classes – symmetry elements – 2D, 3D lattices – Bravais lattices – Symmetry point groups – Atomic scattering factor – Structure factor.

Defects in solids: Point defect – Line defect – Surface defect – volume defect – effects of crystal imperfections.

UNIT – II: LATTICE, VIBRATIONS AND THERMAL PROPERTIES

Vibration of monoatomic lattice – Lattices with two atoms per primitive cell – Quantization of lattice vibrations – Phonon momentum – Inelastic scattering of neutrons by phonons – Lattice heat capacity – Einstein model – Density of modes in one-dimension and three-dimension – Debye model of the lattice heat capacity – Thermal conductivity.

UNIT – III: FREE ELECTRON THEORY, ENERGY BANDS AND SEMICONDUCTOR CRYSTALS

Introduction – Free electron gas – sommerfield model – density of electron states – Schottky effect – Photoelectric effect – Photoelectric emission. Band theory: Energy spectra in atoms molecules and gases – Wave equation in a periodic potential – Bloch theorem – Kronig-penney model – Electrical conductivity and Ohm's law – Motion in magnetic fields – Hall effect – Thermo-electric effect – Peltier effect – Semiconductors – Band gap – Effective mass – Intrinsic carrier concentration.

UNIT – IV: Diamagnetism, Paramagnetism, Ferro Magnetism And Antiferromagnetism

Langevin classical theory of diamagnetism and paramagnetism – Weiss theory – Quantum theory of paramagnetism – Demagnetisation of a paramagnetic salt – paramagnetic susceptibility of conduction electrons – Hund's rules – Kondo effect – Ferroelectric order – Curie point and exchange integral – Temperature dependence of saturation magnetization – Ferromagnetic order – Antiferromagnetic order – Ferromagnetic domains – Origin of domains – Coercive force and hysteresis.

UNIT – V: Dielectrics And Ferroelectrics And Superconductivity

Macroscopic electric field – Local electric field at an atom – Dielectric constant and polarizability – Clausius-Mossotti equation – Polarization catastrophe – Ferroelectric domain – Occurrence of superconductivity – Meissner effect – Thermodynamics of superconducting transition – London equation – Coherence length – BCS theory – Flux Quantization – Type I and Type II superconductors – Josephson superconductor tunneling – DC and AC Josephson effect.

Books for Study and Reference:

1. C. Kerrel, Introduction to Solid State Physics (Wiley Eastern, NewDelhi).
2. N.W. Ashorof and N.D. Mermin, Solid State Physics (Hot. Rinehart and Winston).
3. A.J. Dekker, Solid State Physics, (McMillian, Madras).
4. Gupta and Kumar, Solid State Physics (K. Nath & co., Meerut).
5. M. Arumugam, Material science (Anuradha agencies publishers).
6. S.O. Pillai, Solid State Physics (New Age International, NewDelhi).

Course Code	CORE PRACTICAL – II ADVANCED GENERAL EXPERIMENTS LAB	L	T	P	C
20213SEC24L		0	0	4	2

Aim:

- Experimental determination of certain physical constants and its properties with the suitable experiments.

(Any 10 from the following)

1. Determination of magnetic susceptibility of liquid by Guoy method.
2. Determination of magnetic susceptibility of solid by Guoy method.
3. Determination of magnetic susceptibility of powder sample by Guoy method.
4. Determination of magnetic susceptibility of liquid by quinck's method.
5. Determination of wavelength and thickness of a film by using Michelson's interferometer.
6. Charge of an electron by spectrometer.
7. Polarizability of liquids by finding the refractive index at different wavelength.
8. Determination of wavelength of monochromatic source using biprism.
9. Determination of refractive index of liquids using biprism (scale and telescope method).
10. Determination of specific rotatory power of a liquid using polarimeter.
11. Rydberg's constant using spectrometer.
12. Forbe's method – Thermal conductivity.
13. Laser grating – Determination of wavelength.
14. Optical Fiber – Numerical aperture.
15. Brass Arc spectrum.

Course Code	DISCIPLINE SPECIFIC ELECTIVE COURSE-II	L	T	P	C
20213DSC25A	ATOMIC AND MOLECULAR PHYSICS	5	0	0	4

Aim:

• To familiarize with the basic principles of various spectroscopic techniques and their applications in the determination of atomic structure, chemical composition and physical properties of materials.

UNIT - I: Atoms In External Fields And Quantum Chemistry

Quantum theory of Zeemen, Stark and Paschen Back effect.

Quentum Chemistry Of Molecules:

Born – Oppenheimer approximation – Heitler – London theory of hydrogen – Concept of atomic, hybrid and molecular orbital's- LCAO treatment of molecular orbitials of CH_4, C_2H_6 and C_2H_4- Huckels molecular approximation- Application to butadiene and benzene.

UNIT – II: Microwave Spectroscopy

Rotational spectra of diatomic molecules – Rigid rotator – Non rigid rotator – Effect of isotopic substitution – Rotation spectra of polyatomic molecules – linear, symmetric top and asymmetric top molecules – Experimental technique.

Ir Spectroscopy:

Vibrating diatomic molecule – Vibrating Rotator – Linear symmetric top molecule – characteristics and group frequencies – Experimental technique.

UNIT –III: RAMAN SPECTROSCOPY

Raman effect and Quantum theory of Raman effect - Rotational and vibration Raman shifts of diatomic molecules

ELECTRONIC SPECTROSCOPY OF MOLECULES:

Electronic Spectra of Diatomic Molecules – Frank Conden Principle – Dissocation energy and Dissocation products – Rotational fine structure of electronic vibration transitions .

UNIT – IV: RESONANCE SPECTROSCOPY

NMR:

Basic principles – Classical and Quantum Mechanical Description – Bloch equations – Spin – Spin and Spin lattice relation times – Experimental method – Single coil & double coil methods – high resolution methods.

ESR:

Basic Principle ESR Spectrometer – Nuclear interaction & Hyperfine structure – Relaxaction effects – g- factor – characteristics – Free readial studies & biological application.

UNIT – V: LASERS

Emission and absorption of radiation – Einstein relations – absorption of radiation – population inversion – Optical feedback – Threshold conditions – Laser modes – Single mode operation – frequency Stabilization – mode locking – laser applications – Holography – Holographic computer memories – Laser induced nuclear fusion.

Books for Study & Reference

1. C.N. Bannwell – Fundamental of molecular spectroscopy
2. B.P. Straughan & S. Walker – Spectroscopy – Vol -1
3. H.S. Marry & G.K. Metita – Introduction to Modern physics
4. A.K. Chandra, Introductory quantum Chemistry
5. Proble, Sctineducer & Berstein, High Resoluction NMR
6. G.M. Barrow, Introduction to Molecular Spectroscopy
7. C.P. Slotcher, Principles of Magnetic Resonance
8. R. Charng, Basic Principles of Spectroscopy.
9. J. Wilson, J.F.B. Hawkes Optoelectronics an introduction, Prentice Hall of India, New Delhi.
10. Pallab Bhattacharya, Semiconductor optoelectronic devices Prentice Hall of India, New Delhi

Course Code	DISCIPLINE SPECIFIC ELECTIVE COURSE-II	L	T	P	C
20213DSC25B	RADIATION PHYSICS	5	0	0	4

Aim:

The material in this section is designed to teach the basics of radiological physics, interaction of radiation with matter, basic dosimetric concepts and radiation detectors.

Unit1: Ionizing & Non ionizing Radiation

Electromagnetic spectrum- Different sources of Non Ionizing radiation-Radiofrequency, Microwaves, Infrared, Visible and Ultra violet radiation production, physical properties and their interaction with tissues. Radiation quantities and units - Radiometry - particle flux and fluence - energy flux and fluence -Linear and mass attenuation coefficients – Mass energy transfer and mass energy absorption coefficients

Unit 2: X-Ray Generators

Discovery- Production – Properties of X-rays – Characteristics and continuous spectra– Design of hot cathode X-ray tube – Basic requirements of medical diagnostics, therapeutic and industrial radiographic tubes – Rotating anode tubes – Hooded anode tubes – Industrial X-ray tubes - Safety devices in X-ray tubes –X ray tubes for crystallography.

Unit 3: Particle Accelerators

Particle accelerators for industrial, medical and research application – The Resonant transformer – Cascade generator – Van De Graff Generator – Pelletron – Cyclotron – Betatron Synchro-Cyclotron – Linear Accelerator – Klystron and magnetron –Travelling and Standing Wave Accelerations – Microtron – Electron Synchrotron –Proton synchrotron.

Unit 4: Interaction of photons with Matter

Interaction of electromagnetic radiation with matter- Photoelectric and Compton process and energy absorption – Pair production – Attenuation and mass energy absorption coefficients – Relative importance of various processes.

Unit 5: Interaction of charged particles with Matter

Classical theory of inelastic collisions with atomic electrons- Energy loss per ion pair by primary and secondary ionization –Dependence of collision energy losses on the physical and chemical state of the absorber - Cerenkov radiation – Electron absorption process – Scattering

Excitation and Ionization –Radiative collision - Bremstrahlung – Range energy relation - Continuous slowing down approximation(CSDA) – transmission and depth dependence methods for determination of particle penetration – empirical relation between range and energy

Books for Reference:

1. Faiz M. Khan, The Physics of Radiation therapy, LIppincott Williams & Wikins, Philadelphia, 3rd edition, 2003.

2. W.R. Hendee, Medical Radiation Physics, Year Book Medical Publishers Inc., London,2003.
3. R. E. Lappp, Nuclear Radiation Physics (Prentice-Hall Inc., New York, 2048).

4. L. Slack and K. Way, Radiations from Radioactive Atoms in frequent use,(United States Government Printing Office, Washington, 2059).

5. K. S. Krane, Introductory Nuclear Physics (John-Wiley, New York 2087).

Course Code	RESEARCH METHODOLOGY	L	T	P	C
20213RMC26		3	0	0	2

Aim:

- To enhance the ability of research work along with document preparation for journal publication.

UNIT I: Introduction To Research Methodology

Objectives of research – Types of research – Significance of research. Research methods versus methodology – Research and scientific method – Criteria of good research – Problems encountered by researchers in India.

UNIT II: Database And Literature Survey

Articles – Thesis – Journals – Patents – Primary sources of journals and patents – Secondary sources – Listing of titles – Abstracts – Chemical Abstract Service –Reviews – Monographs – Literature search.

UNIT III: Data Analysis And Chemical Packages:

Precision and accuracy – Reliability – Determinate and random errors – Distribution of random errors – Normal distribution curve – Statistical treatment of finite samples – t test and F test (ANOVA) co -variance (ANCOVA) correlation and multiple regression analysis– Chemical Packages – ChemDraw – ChemSketch – ISIS draw – Origin.

UNIT IV: Thesis And Paper Writing:

Conventions in writing – General format – Page and chapter format – Use of quotations and footnotes – Preparations of tables and figures – References – Appendices.

UNIT V: Laboratory Safety And Numerical Methods

Basic laboratory guidelines – safety equipment – Leaking compressed gas cylinders – electrical safety. Fire – fire extinguishers. Laboratory injuries and treatment. Chemical spills – Mercury and Biohazardous – clean up procedure - Accident management - Disposal of chemicals and glass wares.

Solutions of equations - Simple iterative methods - Newton - Raphson method - Numerical Integration - Simpson’s 3/8 rule - Runge Kutta method II order - Solution of

Simultaneous equation - Differentiation - Numerical differentiation with interpolation polynomials.

References:

1. C. R. Kothari, Research Methodology, New Age International Publishers. New Delhi, 2004.

2. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 2099.

3. D.G Peters, J.M. Hayes and G.M. Hefige, A brief introduction to Modern chemical analysis.

4. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2005.

5. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand and Sons, New Delhi, 2005.

6. E. Balagurusamy, Numerical methods, Tata McGraw-Hill

7. S.S. Sastry, Introductory Methods of Numerical analysis, PHI, N.Delhi

Course Code	CORE PAPER – VII ELECTROMAGNETIC THEORY	L	T	P	C
20213AEC31		6	1	0	6

Aim:

- To learn the theory for the fields produced by stationary and moving charge and charged systems and propagation of electromagnetic fields.

UNIT – I: INTRODUCTION TO ELECTROSTATICS

Coulomb's law- Electric field – Gauss Law – Scalar potential – Surface distribution of charges and dipoles – Poisson and Laplace Education – Green's theorem – Dirichlet and Neumann boundary conditions – electronic static boundary value problems : Methods of Images Illustrations: Point charge in the presence of (i) a grounded conducting sphere. (ii) a charged insulated and conducting sphere.

UNIT – II: ELECTROSTATICS OF MACROSCOPIC MEDIA

Multipole expansion – Boundary value problems with dielectric Illustration (i) a point charge embedded at a distance away from a dielectric interface. (ii) Dielectric sphere in a uniform electric field. Molecular polarizability and electric susceptibility Electrostatic energy in dielectric media.

UNIT – III: MAGNETOSTATICS

Biot and Savart law – Force between current currying conductors – Differential equations of magneto statics and Ampere's law – Vector potential – Force and torque and energy of a localized current distribution in an external magnetic induction – Macroscopic equations.

UNIT – IV: Electromagnetics

Faraday's law in induction – Maxwell's displacement current – Maxwell equations Maxwell equations in terms of vector and scalar potentials – Gauge transformations Lorentz gauge, Coulomb gauge – Poynting's theorem – Conservation of energy and momentum for a system of charged particles and electromagnetic fields.

UNIT – V: Electromagnetic Waves And Wave Propagation

Electromagnetic waves – reflection – refraction – dispersion and polarization – wave guides – charge particle in electric and magnetic fields – Radiation from moving charges, dipoles and retarded potentials.

Books for Reference:

1. J.D.Jackson, Classical Electrodynamics, Wiley Easterm 2088.
2. David. J. Griffiths, Introduction to Electrodynamics, PHI, New Delhi, 2095.
3. EC. Jordon and K.G. Balmain , Electromagnetic waves and Radiating System.
4. Chopra & Agrawal, Electromagnetic theory, K.Nath & co- Mccrut.

Course Code	CORE PAPER – VIII NUCLEAR AND PARTICLE PHYSICS	L	T	P	C
20213AEC32		6	1	0	6

Aim:

• To learn the various aspects of nucleus and its behavior under various conditions.

UNIT I: BASIC NUCLEAR PROPERTIES

Nuclear Size, Shape, Mass – Charge Distribution – Spin and Parity – Binding Energy – Semi Empirical Mass Formula – Nuclear Stability – Mass Parabola – Nature of Nuclear Forces – Ground State of Deuteron – Magnetic Dipole Moment of Deuteron – Proton-Neutron Scattering at Low energies – Scattering Length, Phase Shift – Properties of Nuclear Forces – Spin Dependences – Charge Symmetry – Charge Independence – Repulsion at Short Distances – Exchange Forces – Meson Theory.

UNIT II: Radio Active Decays

Alpha Emission – Geiger-Nuttal Law – Gamow Theory – Neutrino Hypothesis – Fermi Theory of Beta Decay–Selection Rules – Non-conservation of Parity – Gamma Emission – Selection Rules-Internal Conversion – Nuclear Isomerism – Interaction of Charged Particles and X-rays with Matter – Basic Principles of Particle Detectors – Ionization Chamber – Proportional Counter and G.M. Counters – Solid State Detectors – Scintillation and Semiconductor Detectors.

UNIT III: Nuclear Reaction And Nuclear Models

Q-Values and Kinematics of Nuclear Cross Section – Energy and Angular Dependence – Reciprocity Theory – Briet-Wigner Formula – Compound Nucleus – Resonance Theory – Optical Model – Shell Model – Liquid Drop Model – Collective Model.

UNIT IV: ACCELERATORS AND REACTORS

Cyclotron – Synchrocyclotron – Betaron Synchrotron – Linear Accelerators – Characteristic of Fission – Mass Distribution of Fragments – Radioactive Decay Process –Fission Cross Section – Energy in Fission – Bohr-Wheeler's Theory of Nuclear Fission – Fission Reactors – Theral Reactors – Homogeneous – Reactor – Heterogeneous Reactors – Basic Fusion Processes – Characteristic of Fusion – Solar Fusion – Controlled Fusion Reactors.

UNIT V: ELEMENTARY PARTICLES

Building Block of Nucleus – Nucleons, Leptons, Mesons, Baryons, Hyperons, Hadrons, Strange Particles – Classification of Fundamental Forces and Elementary Particles – Basic Conservation Laws – Additional Conservation Laws: Baryonic, Leptonic, Strangeness and Isospin Charges/Quantum Numbers – Gell-Mann-Nishijima Formula – Multiplets – Invariance Under Time Reversal (T) Charge Conjugation (C) and Parity (P) – TCP Theorem – Parity Non-conservation in Weak Interactions – CP Violation –

Eight-Fold Way and Supermultiple – SU(3) Symmetry and quark model – Basic Ideas on the Theories of Weak and Strong Interaction.

Book for Reference:

1. Nuclear Physics, an Introduction by S.B. Patel – (Wily –Eastern, New Delhi).
2. Concepts of Nuclear Physics by B.L. Cohen – (Tata McGraw Hill, New Delhi).
3. Introduction to Elementary Particles by D. Griffiths – (Wily International, New York).

Course Code	CORE PRACTICAL – III ADVANCED ELECTRONICS LAB	L	T	P	C
20213SEC33L		0	0	5	3

Aim:

• Verification of characteristics and applications of electronic components and devices.

(Any 12 from the following)

1. Logic gates – Universality of NAND/NOR gates using IC's.
2. Verification of Demorgans theorems and Boolean Expressions.
3. Astable and bistable and monostable multivibrator using IC 555.
4. Wein's bridge oscillator using IC 741.
5. Construction of dual regulated power supply.
6. Half and Full wave precision rectifier using IC 741.
7. Study of the characteristics of Load cell.
8. Digital to analog converter – R-2R method and weighted method.
9. Study the function of multiplexer and demultiplexer.
10. Study the function of decoder and encoder.
11. Flip flops.
12. Half adder and Full adder (using only NAND gates).
13. Half subtractor and Full subtractor (using only NAND gates).
14. Digital comparator using XOR and NAND gates.
15. Study of counter using IC 7490 (0 - 9).
16. Analog to digital converters – Born approximation method.
17. Calibration of thermistor.
18. Study of the characteristics of Strain gauge.

Course Code	DISCIPLINE SPECIFIC ELECTIVE COURSE-III NON CONVENTIONAL ENERGY PHYSICS	L	T	P	C
20213DSC34A		5	0	0	4

Aim:

- To learn about geothermal energy, energy from oceans and hydrogen and its applications.

UNIT – I: Geothermal Energy

Geothermal Energy – Nature of geothermal fields – Geothermal sources – Hydrothermal resources – Vapour Dominated systems – Liquid dominated systems – Geopressured resources – Hot dry rock resources – Magma resources – Advantages and disadvantages – applications of geothermal energy.

UNIT –II: Energy From Oceans

Ocean thermal electric conversion – Open cycle OTEC system – closed cycle OTEC system – Energy from tides – Principle of tidal power – Components of tidal plants – operation methods of utilization of tidal energy – wave energy conversion by floats – High level reservoir wave machine – The Dolphin type wave power machine – Estimate of energy and power in Tidal system – Advantages and Limitations of Tidal power generation.

UNIT –III: Hydrogen Energy

Introduction to Hydrogen energy – Properties of Hydrogen – Hydrogen production – Electrolytic production – tank type electrolyzer – Fossil field methods – Coal gasification for the production of Hydrogen – Coal gasification plants – Solar energy methods - Hydrogen Transportation – Safty rules in handling Hydrogen fuel – Hydrogen storage.

UNIT – IV: MHD Power

Magneto hydro dynamic power generation (MHD) – Principles of MHD power generation – MHS systems – open cycle systems – closed cycle systems – Liquid metal system – Advantages of MHD.

UNIT – V: Energy Conservation

Economic concept of energy – Principles of energy conservation and energy Audit – Different types of Audit – Co-Generation – types of Co-generation – Heat Recuperators – Uses of heat recuperators – Heat generators.

Books for Study:

1. Non- Conventional Energy Sources – G.D. Rai, Kannah Publication.

Course Code	DISCIPLINE SPECIFIC ELECTIVE COURSE-III	L	T	P	C
20213DSC34B	PHOTONICS DEVICES AND APPLICATIONS	5	0	0	4

Aim:

- To learn the basic principles and working of lasers, basic processes and features of nonlinear optical materials and fiber optics.

UNIT – I: SOLID STATE LASERS

Solid state crystalline and glass Lasers – Advantages – Construction of the Ruby Laser – Mechanism of Excitation of the Ruby Laser – Neodymium Lasers – Nd-YAG Laser Nd-glass Laser – Alexandrite Laser – Fiber Glass Laser – Solid state Tunable Laser – Titanium Sapphire Laser – Colour center Lasers – DPSSL.

UNIT – II: LIQUID AND DYE LASERS

Geometry of Dye lasers – Pulsed Dye lasers pumped by Flash lamps – Tunable pulsed lasers pumped by other lasers – Tunable continuous Wave Dye lasers – Mode-locked Ring Dye lasers – Mechanism of Excitation of Mode – locked Ring Dye laser – Helium-neon Laser – Argon Iron Laser – Krypton Ion laser – Metal Vapour lasers – Carbon Dioxide Laser – Gas Dynamic Laser – Nitrogen Laser.

UNIT – III: CHEMICAL, X-RAY AND FREE ELECTRON LASERS

Hydrogen chloride laser – Hydrogen fluoride laser – X-ray lasers – Free Electron Lasers (FEL) – Characteristics of semiconductors lasers – Semiconductor diode lasers – Heterojunction semiconductors materials – Double Hetero structure Laser – Quantum – well Lasers – Higher power Semiconductor Diode Lasers – Single Mode Lasers – Multimode Lasers – Surface – Emitting Lasers (SELs).

UNIT – IV: Industrial Applications of Lasers (Material Processing)

High Power Gas Lasers – Material Processing with Lasers – Metals and Lasers Interactions – Materials Processing mechanism – Hole Drilling with Lasers – Cutting Process with Lasers - Laser Welding – The Welding Process – Micro Laser Welding – Deep Penetration Welding (High Power Laser Welding) Laser Hardening – Marking with Lasers – Wire Striping with laser – Lasers in Nuclear Science – Isotope Separation – Lasers in Spectroscopy – Lasers in Chemistry – Light Detecting and Ranging (LIDAR).

UNIT – V: Laser Communication / Holography and Its Applications / Medical Science

Optical Sources for fiber optical communication – Photo (or photon) Detectors – Operation of Optical Receivers – Essential Characteristics of Laser in Fiber Optic Communication – Types of

Holograms – Intensity Distribution in a Hologram – Fourier Hologram – Thick Hologram – Colour Holograms – Computer Holograms – Holographic Microscopy & Applications – Laser Diagnostics – Photo medicine – Lasers in Ophthalmology – Lasers for General Surgery – Lasers In Dermatology – Cardiology – Lasers In Dermatology – Cardiology – Lasers In Density – Lasers Used in Medicine.

Books for Study:

1. Koechner. W. Solid State laser engineering (Springer – Verlag, New York, 2092).
2. Svelto, O. Principles of Lasers (Plenum Press, New York, 2076).
3. Schafer F.P. Dye Lasers (Springer – Verlag, Berlin, 2073).
4. Rampal, V.V. Lasers and Applications (South Asian Publishers, New Delhi, 2093).
5. Silfvast, W.T. Laser Fundamentals (Cambridge University Press, 2093)
6. Elton, R.C..X-ray lasers (Academic press 2090).
7. Marshall T.C Free – Electron Lasers (Macmillan Publishing Company, New York, 2085).
8. Thomson, G.II.B. Physics of Semiconductor Devices (John Wiley & Sons, New York, 2080).
9. Sze, S.W. Semiconductor Devices, Physics and technology (John Wiley & Sons, New York, 2077).
10. Corzine, S.W., Yan R.H., Coldren and Zory, P. (Editors), Quantum well Lasers (Academic Press, Orlando, 2093).
11. Koebner, H. (Editors), Industrial Applications of lasers (John Wiley & Sons, New York, 2084).
12. Harry, J.E.Industrial Laser and their applications (McGraw Hill, London, 2074).
13. Keiser.G, optical fiber communication (McGraw Hill, 2091).
14. Denisyak and Yu, N. Fundamentals of Holography (Mir Publishers, Moscow, 2084)
15. Hochstrasser, R.M. and Johnson, C.K. “Lasers in Biology” (laser focus/electro-optics, 21.2085).
16. Wolbarst, M.L. “Laser application in Medicine and biology” Vol.1 (Plenum Press, New York, 2071).

Course Code	OPEN ELECTIVE COURSE WRITING FOR THE MEDIA	L	T	P	C
202ENOEC		4	0	0	3

Aim:

- To equip students to enter into the realm of mass media.

Objectives:

- To help students to understand the intricacies of mass media
- To know about the barriers to mass communication
- To understand the function of mass media
- To learn the different kinds of news
- To enhance the different kinds of writing for media

Outcome:

- Understand the intricacies of mass media

UNIT-I

Mass communication- Barriers to mass communication and mass culture- Function of mass media - Media effects, Qualities of media men.

UNIT-II

News- Hard and soft news- Expected and unexpected news- Box news- Follow up news-Scoop-Filters- Human interest stories- Recognizing and evaluating news.

UNIT-III

News and views- News analysis, Editorial, Columns, Article, Middle reviews, Letters-Features.

UNIT-IV

Reporting- Crime, Court, Election, Legislature, Sports, Development Investigative, Interpretative depth.

UNIT-V

Writing for Media-Inverted pyramid style-Feature style-TV/Broadcast, New style writing TV/Radio Documentaries- Writing Advertisements-Practical

References-

Journalism -Susan
Professional Journalism -John Hogenberg
News Writing and Reporting -M.James Neal (Surjeet Publication)
Professional Journalism -M.V Komath
The Journalist's Handbook -M.V Komath
Mass Communication & Journalism -D.S Mehta,

Course Code	Course Title	L	T	P	C
202MAOEC	OPEN ELECTIVE COURSE Applicable Mathematical Techniques	4	0	0	3

Aim:

- To acquaint with the basic concept of Interpolation.

Objectives:

- Understand the basic concept of Interpolation.
- To enhance the knowledge about Assignment Problems, Replacement Problems, Decision Analysis and Game Theory.

Outcomes:

- Students using OR techniques in business tools for decision making
- Students develop Assignment problem and Replacement problems
- Understand the concept of decision analysis and game theory
- Students gets the knowledge about interpolation

UNIT I

Interpolation with unequal intervals: Newton's, Lagrage's, and inverse interpolation

UNIT II

Assignment Problems

UNIT III

Replacement Problems

UNIT IV

Decision Analysis

UNIT V

Game Theory

References

Unit I, "Numerical Methods in Science and Engineering" M.K.Venkatraman

Units II to V, "Operations Research", Kantiswarup, P.K. Gupta and Manmohan

Course Code	OPEN ELECTIVE COURSE GREEN CHEMISTRY	L	T	P	C
202CHOEC		4	0	0	3

Objectives: To learn about the environmental status, public awareness in evolution, principles involved in green chemistry, bio-catalytic reactions, global warming and its control measures, availability of green analytical methods.

Unit I - Introduction

Introduction-Current status of chemistry and the Environment-Evolution of the Environmental movement: Public awareness - Dilution is the solution to pollutionPollution prevention.

Unit II - Principles

Green Chemistry – Definition – Principles of Green Chemistry - Why is this new area of Chemistry getting to much attention - Why should chemist pursue the Goals of Green Chemistry - The roots of innovation – Limitations.

Unit III - Bio Catalytic Reactions

Green Chemistry Using Bio Catalytic Reactions – Introduction - Fermentation and Bio transformations - Production of Bulk and fine chemicals by microbial fermentationAntibiotics – Vitamins - Bio catalyses synthesis of industrial chemicals by bacterial constructs - Future Tends.

Unit IV - Green House Effect

Green house effect and Global Warming – Introduction - How the green house effect is produced - Major sources of green house gases - Emissions of CO2 - Impact of green house effect on global climate - Control and remedial measures of green house effect - Global warming a serious threat - Important points.

Unit V - Green Analytical Methods

Future trends in Green Chemistry - Green analytical methods, Redox reagents, Green catalysts; Green nano-synthesis, Green polymer chemistry, Exploring nature, Biomimetic, Proliferation of solvent-less reactions; Non-covalent derivatization, Biomass conversion, emission control

Outcomes:

- To understand the environmental status and evolution.

- To know about the Pollution and its prevention measures.
- To familiarize the green chemistry.
- To learn about the bio-catalytic reactions.
- To understand about the vitamins and antiobiotics.

References:

1. Introduction to Green Chemistry – M.Rayan and M.Tinnesand

2. New Trends in Green Chemistry – V.K.Ahluwalia and M.Kidwai

Course Code	Course Title	L	T	P	C
202CSOEC	Open Elective –M- Marketing	4	0	0	3

Aim

Course OBJECTIVES

- Understand Mobile Business strategies.
- To understand Mobile marketing tools and techniques.
- To know Mobile technologies.

Course Outcome

- Upon Completion of the course, the students should be able to:
- Analyze various mobile marketing strategies.
- Market Mobile based Applications.
- Apply various tools in mobile marketing.

UNIT I Introduction

Mobile Marketing Campaign, Fortune 500 and Mobile Marketing, consumers engagement with mobile, Terminologies.

UNIT II Businesses Vs mobile marketing

classic mistakes in mobile marketing, laying foundation for successful mobile marketing campaign, understanding technology behind mobile marketing – Android, iOS, Windows Phone.

UNIT III

Strategic thinking about Mobile marketing campaign, Mobile Marketing Tools – setting up mobile website for different firms, using SMS, MMS and apps to drive customers to business and other ways to attract customers.

UNIT IV Location Based Marketing

LBS, NFC, Bluetooth and LBA, 2D codes, Tablet, Other Mobile Applications, Business Firms connecting to customers using Mobile – case study, Mobile Marketing for B2B companies, Mobile E-commerce to Drive Revenue.

UNIT V Mobile Payments

Present and Future Mobile Technology, Mobile Application Development.

REFERENCE BOOKS:

1. Go Mobile: Location Based Marketing, Apps, Mobile Optimized Ad Campaigns, 2D codes and other Mobile Strategies to Grow your Business, Jeanne Hopkins, Jamie Turner, John Wiley&Sons Inc., 2012.
2. M- Commerce, Paul Skeldon, Crimson Publishing, 2012. M-Commerce Technologies, Services and Business Models, Norman Sadeh , Wiley 2002.
3. Mobile Commerce, Opportunities, Applications and Technologies of Wireless Business, Paul Mary, Tom Jell, Cambridge University Press, 2001.

Course Code	Course Title	L	T	P	C
202CMOEC	Open Elective –FINANCIAL SERVICES	4	0	0	3

AIM

To analyze the various financial institutions and their services.

Course Objectives

- To gain knowledge on financial services.
- To understand importance of various services including banking, insurance, mutual funds.

Course OUTCOME

- To introduces meaning and functions of Financial Intermediaries
- To understand the role of merchant bank and its services
- To provide information regarding management of mutual funds and Regulations
- To understand the role and functions of financial services Marketing
- To know the structure and types of debt Instruments
- To realize Foreign Exchange Market

UNIT – I

Financial system-An Overview: Indian Financial System-Global Financial System-FinancialServices Environment- Credit Rating –Factoring and Forfeiting –Leasing

UNIT – II

Financial Markets –An Overview: Definition-Role-Functions-Constituents-FinancialInstruments-Capital Market instruments-Indian money and Capital Market-Global Financial

Markets.

UNIT – III

Money Market –An Overview: Definition-Characterstistics-Objectives-Imporatance-Functions-Segment-Financial Institutions-Indian Money Market-Global Money Market

Unit – IV

Capital Market: Money Market-Characteristics-Functions-New financial Instruments-measuresof Investor Protection-Indian Capital Market-Major Issues

Unit-V

Stock Exchange: History of Stock Exchange-Functions-Indian Stock Exchanges-Organizationstructure-Regulations of Stock Exchange –Recent Developments

REFERENCE BOOKS

1. Gordon , Natarajan – Financial Market and Services.

2. Dr. S. Gurusamy – Financial services and Market.

3. Kucchol S.C. – Financial Management

4. Pandey I.M. – Financial Management.

Course Code	Course Title	L	T	P	C
20215OEC	Open Elective -Herbal Medicine	4	0	0	3

Aim:

- Be able to advise and educate effectively to create a comprehensive wellness plan incorporating herbal, dietary and lifestyle recommendations integrating self-awareness and lessons of nature

Objective

- Possess knowledge of traditional herbal systems as well as an understanding of the principles and practices of modern Western herbalism
- Demonstrate the ability to critically analyze herbal research and contribute to the current body of herbal literature
- Know how to integrate knowledge of raw materials, formulation, and herbal pharmacy for product development purposes
- Know how to effectively educate individuals and groups about herbs
- Be able to demonstrate basic skills in herb identification, harvesting, and preparation
- Be able to address potential safety concerns including herb-drug interactions

Outcomes

- Accurately gather information regarding past and current health status while differentiating between phenomena and the client's interpretation of phenomena
- Synthesize the above information to create a comprehensive assessment of health inputs and processes
- Work with clients to develop individualized goals and a plan for health and wellness

Unit I

Tribal medicine – methods of disease diagnosis and treatment – Plants in folk religion – Aegle marmelos, Ficus benghalensis, Curcuma domestica, Cyanodon dactylon and Sesamum indicum.

Unit II

Traditional knowledge and utility of some medicinal plants in Tamilnadu – Solanum trilobatum, Cardiospermum halicacabum, Vitex negundo, Adathoda vasica, Azadirachta indica, Gloriosa superba, Eclipta alba, Aristolochia indica and Phyllanthus fraternus.

Unit III

Plants in day today life – Ocimum sanctum, Centella asiatica, Cassia auriculata, Aloe vera. Nutritive and medicinal value of some fruits (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate) and vegetables - Greens (Moringa, Solanum nigrum Cabbage).

Unit IV

Allergens – types – sources – active principles – Chemical nature – Cell modifiers – Lectins – mutagens, teratogens – Allergic reactions with known examples.

Unit V

Cardiovascular diseases – blood pressure – cardiac drugs of plant origins – alkaloids, anticoagulants – basic mechanism of action. Pulmonary / respiratory disorders – asthma – bronchitis – common cold – allergy – Remedy from plants.

Reference Books

1. Tribal medicine – D.C. Pal & S.K. Jain Naya Prakash, 206, Bidhan Sarani, Calcutta , 1998
2. Contribution to Indian ethnobotany – S.K. Jain, 3rd edition, Scientific publishers, B.No. 91, Jodhpur, India. 2001
3. A Manual of Ethnobotany – S.K.Jain, 2nd edition, 1995.
4. Kumar, N.C., An Introduction to Medical botany and Pharmacognosy. Emkay Publications, New Delhi. 1993.
5. Rao, A.P. Herbs that heal. Diamond Pocket Books (P) Ltd., New Delhi, 1999

Course Code	CORE PAPER – IX	L	T	P	C
20213AEC41	LASER PHYSICS AND NON-LINEAR OPTICS	6	1	0	6

Aim:

The aim and objective of the course on Laser Physics and Non-linear Optics is to expose the M.Sc. students to the basics of the challenging research field of Laser Physics and their use in nonlinear optics.

UNIT I: Lasers-Fundamentals and Types

Basic Construction and Principle of Lasing-Einstein Relations and Gain Coefficient - Creation of a Population Inversion- Three-Level System - Four-Level System -Threshold Gain Coefficient for Lasing- Laser types-He-Ne Laser-CO_2 Laser- Nd:YAG Laser- Semiconductor Laser.

UNIT II: Laser Operation

Optical Resonator-Laser Modes-Axial modes- Transverse modes-Modification in Basic Laser Structure- Basic Principle of Mode Locking- Active Mode Locking -Passive Mode Locking-Q-Switching- Pulse Shaping.

UNIT III: Laser Beam Characteristics:

Wavelength-Coherence-Mode and Beam Diameter-Polarizations-Introduction to Gaussian Beam width-Divergence-Radius of Curvature-Rayleigh Range-Guoy Phase Shift-3-D Gaussian Beams -ABCD Law for Gaussian Beam-The Complex Radius of CurvatureTensorial ABCD Law.

UNIT IV:Focusing of Laser Beam

Diffraction- Limited spot size-M 2Concept of Beam Quality-Spherical Aberration-Thermal Lensing Effects-Depth of Focus-Tight focusing of laser beam - Angular Spectrum Representation of Optical Near Field-Aplanatic lens-Focusing of Higher-order laser modes-Radially Polarized Doughnut mode-Azimuthally Polarized Doughnut mode.

UNIT V:Non-Linear Optics

Introduction-Non-linear Optical Media-The Non-linear Wave Equation-Scattering Theory Born Approximation-Second-order Nonlinear Optics-Second-Harmonic Generation (SHG) and Rectification-The Electro-Optic Effect-Three-Wave Mixing-Frequency and Phase

Matching-Third Harmonic Generation-Optical Kerr Effect- Self-Focusing- Four-Wave Mixing (FWM) - Optical Phase Conjugation (OPC)- Use of Phase Conjugators in Wave Restoration.

References:

1. Nanomaterials: Processing and Characterization with Lasers.-Subhash Chandra Singh, Haibo Zeng, ChunleiGuo, and WeipingCai -Wiley-VCH Verlag GmbH & Co. KGaA.(2012).

2. Walter Koechner-Solid State Laser Engineering-6 th edition-Springer

3. Principles of Nano optics -L. Novotny and B. Hecht-Cambridge University Press(2006)

4. Encyclopedia of Optical Engineering- R.G.Driggers,C.Hoffman- Marcel Dekker(2003)

5. Laser Material Processing- M. Steen, J.Mazumder- Springer (2010)

6. Fundamentals of Photonics - Bahaa E. A. Saleh, Malvin Carl Teich-John Wiley & Sons, Inc.

Books for study:

1. Nonlinear Optics – D.L. Mills - Basic Concepts, Springer, Berlin 2098.

2. Lasers and Nonlinear Optics -B.B. Laud-2nd Edn. New Age International (P) Ltd., New Delhi, 2091

Course Code	CORE PAPER – IX	L	T	P	C
20213AEC42	NUMERICAL METHODS AND COMPUTATIONAL PHYSICS	6	1	0	6

Aim:

The aim and objective of the course on numerical methods and computational physics is to expose the M.Sc. students to the basics of the challenging research field.

UNIT I: NUMERICAL DIFFERENTIATION AND INTEGRATION

Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT II: INTERPOLATION AND APPROXIMATION

Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines – Difference operators and relations – Interpolation with equal intervals – Newton's forward and backward difference formulae.

UNIT III: SOLUTION OF EQUATIONS, EIGENVALUE ANDINITIAL VALUE PROBLEMS

Fixed point iteration method – Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel – Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.Taylor's series methods – Euler's method – Modified Euler's method – Fourth orderRunge – Kutta method for solving first order equations.

UNIT IV: BASICS OF PYTHON PROGRAMMING

Need for computer languages, Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

Introduction-Python: Interpreter-Interactive and script mode -Values and types, variables, operators, expressions, statements, precedence of operators, Multiple assignments, comments, input function, print function, Formatting numbers and strings, implicit/explicit type conversion.

UNIT V:PROBLEM SOLVING USING PYTHON PROGRAMMING

Control statements and strings in python:Conditional (if), alternative (if-else), chained conditional (if-elif-else). Strings-String slices, string methods and operations.

Functions and Files: Introduction, inbuilt functions, user defined functions, passing parameters - Positional arguments, default arguments, keyword arguments. Files -Text files, reading and writing files.

Data structures: Lists-creating lists, list operations, list methods, Sets-creating sets, set operations - Tuples-Tuple assignment - Dictionaries-operations and methods, Nested Dictionaries.

REFERENCES

1. E. Balaguruswamy, Numerical Methods (Tata McGraw Hill, Noida, India), 2009.
2. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Pvt.Ltd.,NewDelhi,2012.
3. ReemaThareja, "Problem Solving and Programming with Python", OxfordUniversity Press, 2018.
4. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016(http://greenteapress.com/wp/think- python/)
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction toProgramming in Python: An Inter-disciplinary Approach", Pearson IndiaEducation Services Pvt. Ltd., 2016.

Course Code	CORE PRACTICAL – IV Numerical Methods with C++ Programming Lab	L	T	P	C
20213SEC43L		0	0	5	3

Aim:

• To develop programming skills of Numerical Methods with C++ programming in solving some mathematical problems and their applications.

SECTION B

1. Roots of algebraic equations – Newton-Raphson method.
2. Least-square curve fitting-Straight line fit.
3. Solution of simultaneous linear algebraic equations – Gauss elimination method.
4. Solution of simultaneous linear algebraic equations – Gauss Seidal method.
5. Interpolation – Lagrange method.
6. Numerical integration – Composite trapezoidal rule.
7. Numerical integration – Composite Simpson's rule.
8. Numerical differentiation – Euler method.
9. Solution of ordinary differential equations – Runge – Kutta 2^{nd}order method.
10. Solution of ordinary differential equations – Runge – Kutta 4^{th} order method.

Course Code	DISCIPLINE SPECIFIC ELECTIVE COURSE-IV	L	T	P	C
20213DSC43A	NANO SCIENCE AND TECHNOLOGY	5	0	0	4

Aim:

• To learn the structures, properties, characterization and applications of nanomaterials.

UNIT – I: NANO POWDERS AND NANO MATERIALS

Preparation – Plasma arcing chemical vapour deposition – Sol–gel Technique – Silica gels – Hydrolysis – Condensation and Polymerization of monomer to form particles – Zirconia and yttrium gels – Aluminosilicate gels – Forming nanostructured surfaces using the sol – gel process – Trapping by Sol – gel Electrodeposition – Ball millig – Application of nanomaterials – Insulation materials – Machines tools–Phosphors – Batteries – High power magnets – Motors vehicles and aircraft – Medical Implants – Other medical uses.

UNIT – II: Molecular Nanotechnology Tools

Atoms by inference Electron microscope – Scanning electron microscope – Modern transmission electron microscopes – Scanning probe microscopy – Atomic force microscope – Scanning tunneling microscope – Nanomanipulator – Nanotweezers – Atom manipulation – Nanodots.

UNIT – III: THE CARBON AGE AND NANO BIOMATERIALS

New forms of carbon – Types of nanotubes – Formation of nanotubes – Methods and reactants – Arcing in the presence of cobalt – Laser methods – Chemical vapour deposition method – ballmilling – other methods – Assemblies – purification of carbon nanotubes – The properties of nanotubes – Conductivity – Strength and elasticity – Uses of nanotubes – Electronics – hydrogen storage – Materials – Mechanical machines – Space elevators.

UNIT-II: Optics, Photonics And Solar Energy

Properties of light and nanotechnology – Reflectance of light – Transmission of light – Polarization of Radiation – Interaction of light and nanotechnology – Photon trapping and plasmas – Dielectric constant and polarization - Refractive index – nanoholes and photons – Imaging – New low cost energy efficient windows in solar absorbers, base on nanoparticles – Nanometals – Nanotechnology and day night – Solar cells, nanoparticles and nanostructure – Optically use full nanostructred polymers – Polymeric crystals, surface wave guides and control of light paths.

UNIT – V: NANOELECTRONICS & FUTURE APPLICATION

The tools of micro and nanofabrication – Optical lithography – electron beam lithography – Atomic lithography – molecular beam epitaxy – Quantum electronics devices – High electron mobility transistors – Quantum interface transistors – Carbon nanotube transistors Molecular electronics –DNA – Directed assembly and application in electronics – Quantum Information and quantum computers – Nan

machines and nano elasticity – nanoparticle coating – special new effects – Nano electronics and magnetic devices – new computing systems – Optoelectronics devices – Light emiting diodes – Thermionic solar power –Environmental applications.

Books for Study:

Mick Wilson, K.K Geroff Smith,Michelle and Bukhard Raguse, Nano technology –Basic science and Emerging technologies, Overseas press 2005.

Course Code	DISCIPLINE SPECIFIC ELECTIVE COURSE-IV	L	T	P	C
20213DSC43B	NON-LINEAR DYNAMICS	5	0	0	4

Aim:

• To learn the basic principles and working of linear and nonlinear systems with the applications.

UNIT – I: Linear And Nonlinear Systems

Linear and non linear forces – Non linear dynamical systems – Effects of non linearity – Phase space – Liouville theorem – Solution of damped and forced linear oscillator – Resonance phenomenon – Duffin oscillator – Jump phenomenon.

UNIT – II: Fixed Points And Stability Analysis

Stable and unstable fixed points – Classification of fixed points in first and second order systems – Limits cycle motion – Bifurcations; Saddle node, Pitchfork, Transcritical and Hopf bifurcations.

UNIT – III: Bifurcation And Chaos

Logistic map: Stability of period – 1 and 2 fixed points – Period doubling phenomenon – Onset of chaos – Bifurcation diagram – Different routes to chaos: Period doubling quasiperiodic route and intermittency route – Necessary conditions for chaos.

UNIT – IV: Fractals

Self–similarity – Self similarity in Henon attaractor – Properties of fractals – Examples of fractals – Fractal dimenstion – Construction and properties of middle – Third cantor set, Koch curve and sperpinski triangle.

UNIT – V: Solution And Intergrability

Complete intergrability of finite dimensional systems – Painleve analysis to deduct intergrability – Linear ad non linear waves – Conidial and solitary waves – John Scott Russel's observation of solitary waves – K–dv equation – Fermi – Pasta Ulam problem – Numerical experiment of Zabusky and Kruskal – Soliton – Lax pair – Inverse scattering transform method for K–dv equation – Other solution equations – Applications.

Books for Study and Reference:

1. M. Lakshmanan and S. Rajasekar, Nonlinear Dynamics: Intergrability Chaos and Patterns (Spriner–verlag,Berlin,2003).

2. E. Ott. Chaos in Dynamical Systems (Cambridge University Press Cambridge, 2093).

3. H. G. Schuster: Diterministic Chaos (Verlag, Weintein, 2088).

4. H. O. Peiten, P. H. Richter, The Beauty of Fractals (Springer, Berlin, 2086).

5. P. G. Drazin and R. S. Johnson, Solitons: (Cambridge University Press, Cambridge, 2085).

6. M. J. Ablowitz and P. E. Clarkson, solution, non linear Evolution Equation and Inverse Scattering (Cambridge University Press, Cambridge, 2091).

Research Integrated Curriculum

The relationship between teacher and learner is completely different in higher education from what it is in school. At the higher level, the teacher is not there for the sake of the student, both have their justification in the service of scholarship. For the students who are the professionals of the future, developing the ability to investigate problems, make judgments on the basis of sound evidences, take decisions on a rational basis and understand what they are doing and why is vital. Research and inquiry is not just for those who choose to pursue an academic career. It is central to professional life in the twenty-first century.

It is observed that the modern world is characterized by heightened levels of complexity and uncertainty. Fluidity, fuzziness, instability, fragility, unpredictability, indeterminacy, turbulence, changeability, contestability: these are some of the terms that mark out the world of the twenty-first century. Teaching and research is correlated when they are co-related. Growing out of the research on teaching- research relations, the following framework has been developed and widely adopted to help individual staff, course teams and whole institutions analyse their curricula and consider ways of strengthening students understanding of and through research. Curricula can be:

Research – Led: Learning about current research in the discipline

Here the curriculum focus is to ensure that what students learn clearly reflects current and ongoing research in their discipline. This may include research done by staff teaching them.

Research – Oriented: Developing research skills and techniques

Here the focus is on developing student's knowledge of and ability to carry out the research methodologies and methods appropriate to their discipline(s)

Research – Based: Undertaking research and inquiry

Here the curriculum focus is on ensuring that as much as possible the student learns in research and or inquiry mode (i.e. the students become producers of knowledge not just consumers). The strongest curricula form of this is in those special undergraduate programmes for selected students, but such research and inquiry may also be mainstreamed for all or many students.

Research- Tutored: engaging in research discussions

Here the focus is on students and staff critically discussing ongoing research in the discipline.

All four ways of engaging students with research and inquiry are valid and valuable and curricula can and should contain elements of them.

Moreover, the student participation in research may be classified as,

Level 1: Prescribed Research

Level 2: Bounded Research

Level 3: Scaffolded Research

Level 4: Self actuated Research

Level 5: Open Research

Taking into consideration the above mentioned facts in respect of integrating research into the M.Sc (Physics) curriculum, the following Research Skill Based Courses are introduced in the curriculum.

Semester	**RSB Courses**	**Credits**
I	Research Led Seminar	1
II	Research Methodology	3
II	Participation in Bounded Research	2
III	Design Project/ Socio Technical Project (Scaffolded Research)	4
IV	Project Work	12

Blueprint for assessment of student's performance in Research Led Seminar Course

- **Internal Assessment: 40 Marks**
    - Seminar Report (UG)/Concept Note(PG) : 5 X 4= 20 Marks
    - Seminar Review Presentation : 10 Marks
    - Literature Survey : 10 Marks
- **Semester Examination : 60 Marks**

(Essay type Questions set by the concerned resource persons)

Blueprint for assessment of student's performance in Socio Technical Project

- **Continuous Internal Assessment through Reviews: 40 Marks**
    - Review I : 10 Marks
    - Review II : 10 Marks
    - Review III : 20 Marks
- **Evaluation of Socio Technical Practicum Final Report: 40 Marks**
- **Viva- Voce Examination: 20 Marks**
- **Total: 100 Marks**

Blueprint for assessment of student's performance in Research Methodology Courses

Continuous Internal Assessment: 20 Marks

- Research Tools(Lab) : 10 Marks
- Tutorial: 10 Marks

Model Paper Writing: 40 Marks

- Abstract: 5 Marks
- Introduction: 10 Marks
- Discussion: 10 Marks
- Review of Literature: 5 Marks
- Presentation: 10 Marks

Semester Examination: 40 Marks

Total: 100 Marks

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