INVERTIS
UNIVERSITY BAREILLY

CBCS Scheme of Instruction & Syllabi

of

Bachelor of Science
(Physics, Chemistry & Mathematics)
Third Year

(Effective from the academic session 2020- 2021)

Department of Applied Science & Humanities

INVERTIS UNIVERSITY

Invertis Village,
Bareilly-Lucknow NH-24,
Bareilly, U.P. (243123)

15-10-20

Head
Department of Applied Science
Invertis University, Bareilly (U.P.)

Dean
Faculty of Science
Invertis University, Bareilly (U.P.)

15/10/2020

B.Sc. (Physics, Mathematics and Chemistry)

This program provides an ability to identify and solve significant problems across a broad range of application areas, to develop the aptitude to apply the principles of Chemistry, Physics and Mathematics to articulate an in depth understanding of core knowledge on various subjects of Physical Sciences. It is designed to help students understand the importance of chemicals, chemical industries and the role of these in improving the quality of human life. It also helps students recognize and appreciate the contribution of great scientists in the field of Physics, Chemistry and Mathematics.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

This program acts as a foundation degree and helps to develop critical, analytical and problem solving skills at first level. The foundation degree makes the graduates employable in scientific organizations and also to assume administrative positions in various types of organizations. Further acquisition of higher level degrees will help the graduates to pursue a career in academics or scientific organizations as a researcher.

The Program Educational Objectives are to prepare the students to:

PEO-1. Work alongside engineering, medical, ICT professionals and scientists to assist them in scientific problem solving.

PEO-2. Act as administrators in public, private and government organizations or business administrator with further training and education.

PEO-3. Pursue masters and doctoral research degrees to work in colleges, universities as professors or as scientists in research establishments.

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PROGRAM OUTCOMES (POs)

After undergoing this programme, a student will be able to execute the following successfully:

PO-1. **Scientific knowledge**: Apply the knowledge of mathematics, science, Scientific fundamentals, and scientific specialization to the solution of complex scientific problems.

PO-2. **Problem analysis**: Identify, formulate, research literature, and analyze scientific problems to arrive at substantiated conclusions using first principles of mathematics, nature, and sciences.

PO-3. **Design/development of solutions**: Design solutions for complex scientific problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4. **Conduct investigations of complex problems**: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern scientific tools including prediction and modeling to complex activities with an understanding of the limitations.

PO-6. **Scientific temper and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the practice.

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PO-7. **Environment and sustainability**: Understand the impact of the professional scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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PO-8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the work practice.

PO-9. **Individual and team work**: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO-10. **Communication**: Communicate effectively with their community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

PO-11. **Project management and finance**: Demonstrate knowledge and understanding of scientific and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

PO-12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning and research in the broadest context of scientific & technological change.

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SCHEME OF INSTRUCTION
YEAR III B.Sc. (Physics & Mathematics)

S. No.	Category	Course Code	SUBJECT	PERIODS			Evaluation Scheme		Subject Total	Credit
				L	T	P	CA	EE		
V-SEMESTER										
1	DSE-1A	CPR501	DSE-1P	3	1	0	30	70	100	4
2	DSE-2A	CMR 501	DSE-1M	5	1	0	50	100	150	6
3	DSE-3A	CMR 502	DSE-2M	3	1	0	30	70	100	4
4	SEC	CSE501	SEC-3	2	0	0	15	35	50	2
5	DSE-1A (P)	CPR 551	Physics Lab-V	0	0	4	15	35	50	2
6	DSE-3A(P)	CMR 551	Math Lab-I	0	0	4	15	35	50	2
			TOTAL	**13**	**3**	**8**	**155**	**345**	**500**	**20**
VI-SEMESTER										
1	DSE-1B	CPR601	DSE-2P	3	1	0	30	70	100	4
2	DSE-2B	CPR602	DSE-3P	5	1	0	50	100	150	6
3	DSE-3B	CMR601	DSE-3M	3	1	0	30	70	100	4
4	SEC	CSE601	SEC-4	2	0	0	15	35	50	2
5	DSE-1B(P)	CPR651	Physics Lab-VI	0	0	4	15	35	50	2
6	DSE-3B(P)	CMR651	Math Lab-II	0	0	4	15	35	50	2
			TOTAL	**13**	**3**	**8**	**155**	**345**	**500**	**20**

L-Lecture, **T**-Tutorial, **P**- Practical, **CA**-Continuous Assessment, **EE-Examination Evaluation.**

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SCHEME OF INSTRUCTION
YEAR III B.Sc. (Physics & Chemistry)

S. No.	Category	Course Code	SUBJECT	PERIODS			Evaluation Scheme		Subject Total	Credit
				L	T	P	CA	EE		
V-SEMESTER										
1	DSE-1A	CSR501	DSE-1C	3	1	0	30	70	100	4
2	DSE-2A	CPR 501	DSE-1P	3	1	0	30	70	100	4
3	DSE-3A	CPR 502	DSE-2P	5	1	0	50	100	150	6
4	SEC	CSE501	SEC-3	2	0	0	15	35	50	2
5	DSE-1A(P)	CSR551	Organic Chemistry Lab	0	0	4	15	35	50	2
6	DSE-2A(P)	CPR 551	Physics Lab V	0	0	4	15	35	50	2
			TOTAL	**13**	**3**	**8**	**155**	**345**	**500**	**20**
VI-SEMESTER										
1	DSE-1B	CSR601	DSE-2C	3	1	0	30	70	100	4
2	DSE-2B	CSR602	DSE-3C	3	1	0	30	70	100	4
3	DSE-3B	CPR601	DSE-3P	3	1	0	30	70	100	4
4	SEC	CSE601	SEC-4	2	0	0	15	35	50	2
5	DSE-1B(P)	CSR651	Physical Chemistry lab	0	0	4	15	35	50	2
6	DSE-2B(P)	CSR652	Inorganic Chemistry Lab	0	0	4	15	35	50	2
7	DSE-3B(P)	CPR651	Physics Lab-VI	0	0	4	15	35	50	2
			TOTAL	**11**	**3**	**12**	**150**	**350**	**500**	**20**

L-Lecture, **T**-Tutorial, **P**- Practical, **CA**-Continuous Assessment, **EE-Examination Evaluation.**

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B. Sc. (PCM)

SCHEME OF INSTRUCTION
YEAR III B.Sc. (Chemistry & Mathematics)

S. No.	Category	Course Code	SUBJECT	PERIODS			Evaluation Scheme		Subject Total	Credit
				L	T	P	CA	EE		
V-SEMESTER										
1	DSE-1A	CSR501	DSE-1C	3	1	0	30	70	100	4
2	DSE-2A	CMR501	DSE-1M	3	1	0	30	70	100	4
3	DSE-3A	CMR502	DSE-2M	5	1	0	50	100	150	6
4	SEC	CSE501	SEC-3	2	0	0	15	35	50	2
5	DSE-1A(P)	CSR551	Organic Chemistry Lab	0	0	4	15	35	50	2
6	DSE-3A(P)	CMR551	Math lab-I	0	0	4	15	35	50	2
			TOTAL	**13**	**3**	**8**	**155**	**345**	**500**	**20**
VI-SEMESTER										
1	DSE-1B	CSR601	DSE-2C	3	1	0	30	70	100	4
2	DSE-2B	CSR602	DSE-3C	3	1	0	30	70	100	4
3	DSE-3B	CMR601	DSE-3M	3	1	0	30	70	100	4
4	SEC-4	CSE601	SEC-4	2	0	0	15	35	50	2
5	DSE-1B(P)	CSR651	Physical Chemistry lab	0	0	4	15	35	50	2
6	DSE-2B(P)	CSR652	Inorganic Chemistry Lab	0	0	4	15	35	50	2
7	DSE-3B(P)	CMR651	Math lab-II	0	0	4	15	35	50	2
			TOTAL	**11**	**3**	**12**	**150**	**350**	**500**	**20**

L-Lecture, **T**-Tutorial, **P**- Practical, **CA**-Continuous Assessment, **EE-Examination Evaluation.**

*There will be a 2-credit course on human ethics and entrepreneurship which students can choose at any semester during the program.

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LIST OF SEC

1	MS – Office
2	MATLAB
3	SPSS
4	Mathematica, Latex
5	Maple
6	Chemical Technology & Society
7	Pharmaceutical chemistry

LIST OF DSE

1	Modern Physics
2	Mathematical Physics
3	Atomic & Nuclear Physics
4	Solid State Electronic Devices
5	Condensed Matter Physics
6	Quantum Mechanics
1	Applied Organic Chemistry
2	Physical Chemistry
3	Inorganic Chemistry
4	Advanced Physical Organic Chemistry
5	Introduction to Nanoscience
6	Green Chemistry
1	Elementary Optimization & Numerical techniques
2	Probability & Statistics
3	Algebra
4	Mathematical Analysis
5	Discrete Mathematics
6	Statics and Dynamics

LIST OF SEC

1	MS – Office
2	MATLAB
3	SPSS
4	Mathematica, Latex
5	Maple
6	Chemical Technology & Society
7	Pharmaceutical chemistry

LIST OF DSE

1	Modern Physics
2	Mathematical Physics
3	Atomic & Nuclear Physics
4	Solid State Electronic Devices
5	Condensed Matter Physics
6	Quantum Mechanics
1	Applied Organic Chemistry
2	Physical Chemistry
3	Inorganic Chemistry
4	Advanced Physical Organic Chemistry
5	Introduction to Nanoscience
6	Green Chemistry
1	Elementary Optimization & Numerical techniques
2	Probability & Statistics
3	Algebra
4	Mathematical Analysis
5	Discrete Mathematics
6	Statics and Dynamics

DSE - PHYSICS
DSE-1P MODERN PHYSICS

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite:CPR101 Mechanics, CPR201 Optics, CPR301 Electromagnetism, kinetic theory, Basic statistical mechanics – Maxwell-Boltzmann distribution, black body and its radiation.

Course Objectives:

1. To give an overview of the theory of special relativity, kinetic theory of gases and black body radiation.
2. To give complete knowledge of reference frames, coordinate and interval transformations of special relativity, Michelson-Morley experiment, Lorentz transformation and its consequences to concepts of fundamental quantities like space, time and mass. Maxwellian distribution of molecular velocities, equipartition of energy.
3. To apply the above knowledge in solving numerical problems involving use of basic laws in solving problems
4. To analyse the above knowledge in understanding and interpreting the physical world as 4-D continuum, energy distribution of molecules and Planck radiation law as the most appropriate law for blackbody radiation.
5. To organize the above analysis in selecting the optimum arrangement and conditions for laser action and role of Einstein coefficients.
6. To understand the role of above knowledge in designing of Ruby, He-Ne and carbon dioxide laser and their applications.

Detailed Syllabus

Unit-1: Relativity

Frame of references, Inertial & non- inertial frames, Galilean transformations, Concept of ether ,Michelson-Morley experiment, Postulates of the special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Velocity addition theorem, Variation of mass with velocity, Mass-energy equivalence, Energy-momentum relation

Unit-2: Kinetic Theory

Maxwell's distribution law for speed: average speed, rms speed, most probable speed, Maxwell's distribution law for velocity: average velocity, rms velocity, most probable velocity, Energy distribution of molecules, Temperature dependence, Degree of freedom and equipartition of energy, Mean free path

Unit-3: Radiaton

Introduction to radiation, Properties of thermal radiation, Blackbody radiation, Kirchhoff's law, Energy density and pressure of diffused radiation, Stefan-Boltzmann law, Wien's displacement, Rayleigh-Jeans formula and Planck's radiation law

Unit-4: Laser

Concept of coherence, Absorption, Spontaneous emission and Stimulated emission processes, Relation between Einstein's A and B coefficients, Population inversion, Pumping**,** Main components of Laser, Principle of Laser action, Ruby Laser, He-Ne Laser, CO_2 Laser, Applications of Lasers

Text and Reference Books

Text Book:

1.AurtherBeiser, Concepts of Modern Physics, TMH Publication, New Delhi, 2011

Reference Books:

1. H. S. Mani & G.K. Mehta, Modern Physics, East- West Press Pvt. Ltd
2. B. B. Laud; Lasers, New Age Publication, New Delhi
3. A. K. Ghatak, Physical Optics, Tata McGraw Hill
4. R. Murugeshan, Modern Physics, (S Chand Publication, New Delhi, 2012).

Course Outcomes:

After completing the course, students will be able to achieve the following:

CO1	To define or describe all the introductory level of Special theory of Relativity, Kinetic theory , Radiation and Laser.
CO2	To understand the basic laws and theorems ,Articles required for the study of Special theory of Relativity ,Kinetic theory ,Radiation ,Laser.
CO3	To apply the different methods (formulas) or theorem to solve the numerical problems of relativity. Kinetic theory , Radiation, laser.
CO4	To analyse different transformations, applications, uses of Relativity .Radiation ,Laser,
CO5	To Evaluate the numerical problems of relativity. Kinetic theory , Radiation, laser.
CO6	To Classify the method of Kinetic theory and Radiation.

DSE-2P MATHEMATICAL PHYSICS

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Vector Calculus, Analysis, Differential Equations, Modern Algebra.

Course Objectives:

1. To give an overview of the vector operations and operators – gradient divergence and curl, Orthogonal curvilinear coordinates and vector operations there.
2. To give complete knowledge of forming and solving Laplace and Poisson's equation.
3. To apply the above knowledge in solving Legendre and Bessel equations.
5. To analyse the above knowledge in understanding and interpreting the generating function of above equation's solutions.
6. To develop the Rodrigue's formulae, recurrence relations and orthogonality conditions.
7. To evaluate the Fourier coefficients, sine and cosine series and their applications in practical problems.

Detailed Syllabus

Unit-1: Vector Calculus

Introduction to vectors, Vector operations, Applications of vectors in Physics, Del operator, Gradient, Divergence, Curl and their Physical significance, Laplace and Poisson equations

Unit-2: Orthogonal Curvilinear Co-ordinates

Orthogonal curvilinear coordinates, Derivation of gradient, Divergence, Curl and Laplacian: in cartesian, spherical and cylindrical coordinate systems

Unit-3: Legendre Equations

Solution of Legendre's equation, Rodrigue's formulae, Generating functions, Recurrence relations, Orthogonality

Unit-4: Bessel Equations

Solution of Bessel functions of first and second kind, generating function, recurrence formulas, zeros of Bessel functions and orthogonality conditions

Unit-5: Fourier Series

Introduction to Fourier series, Evaluation of Fourier coefficients, Kronecker's method for computation of Fourier coefficients, Even and odd functions, Sine and cosine series, Applications: square wave, saw-tooth wave, triangular wave, half-wave rectifier, output of full wave rectifier.

Text and Reference Books

Text Book:

1. R. Courant & D. Hilbert, Methods of Mathematical Physics: Partial Differential Equation, New Delhi: Wiley India, 2008
2. Murray R. Spiegel, Schaum's Outline of Theory and Problems of Fourier Analysis, McGraw-Hill, 1974

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics , Wiley Eastern Limited,1985
2. Charlie Harper, Introduction to Mathematical Physics, P.H.I., 1995
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2000
4. Satya Prakash, Mathematical Physics, PragatiPrakashan, 2000

Course Outcomes:

After completing the course, students will be able to achieve the following:

CO1	To define or describe introduction to vector, vector operation, application of vectors in physics, del operator, gradiant, divergence, curl, physical interpretation.
CO2	To understand orthogonal curvilinear coordinates, derivation of gradient, divergence, curl and laplacian in Cartesian
CO3	To apply the different methods or theorem to solve the Questions.
CO4	To analyse the spherical and cylindrical systems and orthogonality conditions.
CO5	To Evaluate the solution of Legendre's equation and Bessel functions, Rodrigues formulae , generating function, recurrence formulas
CO6	To classify all the solutions of Fourier series and application.

DSE-3P QUANTUM MECHANICS

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/Week	Attendance – 20 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 10 Marks
Practicals: 0 hr/Week	Class Test -- 20 Marks
Credits: 6	End Semester Exam – 100 marks

Prerequisite: Basic Quantum theory, Mechanics, Optics, Vector Calculus

Course Objectives:

1. To give an overview of the dual nature of matter and radiation, Davisson-Germer experiment and idea of wave packet.
2. To give complete knowledge of phase and group velocities and relation between them. Heisenberg uncertainity principle and its applications.
3. To apply the above knowledge in arriving at Schrodinger wave equation in time dependent and time independent forms.
4. To analyse the solution of Schrodinger eqution for various cases like potential step, 1D box and barrier penetration.
5. To organize the above analysis in developing the idea of probability current density, expectation values.
6. To describe implications of Ehrenfest theorem and normalization and orthogonal properties of wave function.

Detailed Syllabus

Unit-1: Particles and Waves

Photoelectric effect, Compton effect, Bohr's atomic model, X-rays. Wave nature of matter: de-Broglie hypothesis, Wave-particle duality, Davisson-Germer experiment, Wave description of particles by wave packets, Group and phase velocities and relation between them, wave function and its physical significance

Unit-2: Heisenberg's Uncertainity Principle

Introduction, Derivation from wave packets, Applications of Heisenberg's uncertainty Principle: Non-existence of electrons inside the nucleus, Bohr radius

Unit-3: Schrodinger Equation

Properties of wave function, Derivation of time independent and time dependent Schrodinger wave equation, Application of Schrodinger wave equation: (i) motion of particle in a one dimensional box& extension to 2 & 3 dimensions (ii) Potential step& calculation of reflection & transmission coefficients (iii) Barrier penetration problem (iv) One dimensional harmonic oscillator

Unit-4: Basic Properties of Quantum Mechanics

Probability current density, Expectation values of dynamical variables and their calculation, Ehrenfest theorem, Normalization and Orthogonal properties of wave functions

Text and Reference Books

Text Book:

1. L. I. Schiff, Quantum Mechanics, 3rd edition, McGraw Hill Book Co., New York 1968
2. E. Merzbacher, Quantum Mechanics, 3rd edition, John Wiley & Sons, 1997

Reference Books:

1. J. L. Powell & B.Crasemann, Quantum Mechanics, Addison-Wesley Pubs.Co., 1965
2. Kamlesh K. Sharma, A Text Book of Engineering Physics-II, Pragati Prakashan, 2014
3. AjoyGhatak& S. Lokanathan, Quantum Mechanics: Theory and Applications, 5th Edition, Macmillan India, 2004

Course Outcomes:

After completing the course, students will be able to achieve the following:

CO1	To define or describe Particles and waves,(de-Broglie hypothesis, Heisenberg's uncertainty principle), Schrodinger Equation, Quantum mechanics, Commentator Algebra**,**
CO2	To understand the basic methods or theorems required for the study Particles and waves, (de-Broglie hypothesis Heisenberg's uncertainty principle), Schrodinger Equation, Quantum mechanics, Commentator Algebra,
CO3	To apply the different methods or theorem to solve the problems of Particles and waves Schrodinger Equation,
CO4	To analyse the Quantum mechanics(Probability of finding the particle)Different Commutational operations.
CO5	To Evaluate the problems based on Particles and waves ,Schrodinger Equation etc
CO6	To create Different Commutational operations.

DSE-4PATOMIC AND NUCLEAR PHYSICS

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Modern Physics, Quantum Mechanics

Course Objectives:

1. To give an overview of atomic models both non-relativistic and relativistic, magnetic dipole moment, Stern-Garlach experiment. Alpha, beta and Gamma decay.
2. To give complete knowledge of Nuclear models and radioactivity, Nuclear forces and shell model and magic numbers. Qualitative understanding of Fission and fusion.
3. To apply the above knowledge to solve numerical problems and be able to describe the behavior of the nucleus and the atom.
4. To explain the advantages and disadvantages of different models of atom and nucleus, Soddy-Fajan's displacement law.
5. To organize the above understanding in the design of Van de Graff generator, nuclear counters and detectors.
6. To be able to explain the ingenious design of the modern counters and detectors and compare them.

Detailed Syllabus

Unit-1: Atomic Physics

Introduction to atomic models, Bohr's atom model, Summerfield's relativistic atom model, Vector atom model, Quantum numbers associated with the vector atom model, L-S and j-j couplings, Magnetic dipole moment due to orbital motion of the electron, Magnetic dipole moment due to spin, Stern-Gerlach experiment.

Unit-2: Nuclear Physics

General Properties of the Nucleus, Pauli exclusion principle. Structure of atomic nucleus, Mass defect, binding energy, semi empirical mass formula charges, Size, Spin and Magnetic moment, Elementary idea of Nuclear Forces. Nuclear Models: Liquid drop model and Shell model & magic numbers

Unit-3: Natural Radioactivity

Fundamental laws of radioactivity, Soddy-Fajan's displacement law and law of radioactive disintegration, Basic ideas about α, β and γ decay, Theory & applications of fission& fusion (Qualitative)

Unit-4: Accelerators and Detectors

Van-de Graff Generator, Cyclotron, Betatron, GM counter, Scintillation counter and Neutron detectors

Text and Reference Books

Text Book:

1. Arthur Beiser, Concepts of Modern Physics, McGraw-Hill Book Company, 1987
2. T. A. Littlefield and N. Thoreley, Atomic and Nuclear Physics, Engineering Language Book

Society

Reference Books:

1. A. Beiser, Perspectives of Modern PhysicsMcGraw-Hill, January 1969
2. Irving Kaplan, Nuclear Physics, Oxford Publication, New Delhi
3. S.N. Ghoshal - Nuclear Physics - S. Chand & Co.
4. C. H. Banwell, Molecular Spectroscopy, McGraw Hill
5. D. C. Tayal, Nuclear Physics, Himalya Publication.

Course Outcomes:

After completing the course, students will be able to achieve the following:

CO1	To define atomic and nuclear models in sufficient detail and relate the experimental observations to them. To describe orbital and spin magnetic moments and different coupling schemes.
CO2	To understand the fission and fusion processes and explain Mass defect, binding energy, semi empirical mass formula charges, Size, Spin and Magnetic moment.
CO3	To apply the above knowledge to solve problems using Soddy-Fajan's displacement law and law of radioactive disintegration and problems involving basic ideas about α, β and γ decay
CO4	To evaluate the different atomic and nuclear models and compare them.
CO5	To Evaluate the problems based on Particles and waves ,Schrodinger Equation etc
CO6	To explain the basis of design specifications of modern counters and detectors and suggest modifications for specific requirements.

DSE-5P CONDENSED MATTER PHYSICS

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/Week	Attendance – 20 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 10 Marks
Practicals: 0 hr/Week	Class Test -- 20 Marks
Credits: 6	End Semester Exam – 100 marks

Prerequisite: Modern Physics, Quantum Mechanics, Electromagnetism

Course Objectives:

1. To give an overview of Crystal structure and electrical and magnetic properties of matter.
2. To give complete knowledge of lattice types, coordination number, Miller indices, atomic packing and separation between planes. Bragg spectrometer, Brillouin zones, Concept of hole, band theory and band gap, Bloch theorem and effective mass, Langevin's theory, curie law and hysteresis. To explain in detail Superconductivity and its properties.
3. To apply above knowledge to solve problems on crystal structure, lattice planes, X=ray diffraction, band theory, effective mass of electron in solid, Curie law, hysteresis loss and superconductivity.
4. To analyse the Meissner effect and explain type-I and type-II superconductor behavior and BCS theory. London equations and penetration depth.
5. To organize the crystals in lattice structures, classify solids as conductors, semiconductors and insulators.
6. To create and describe applications of superconductors and of matter based on their crystal structure and their electrical and magnetic properties.

Detailed Syllabus

Unit-1: Crystal Structure

Solids: amorphous and crystalline materials, Lattice translation vectors, Unit cell, Types of Bravais lattices and basis, Coordination number, Miller indices, Atomic packing fraction, Separation between lattice planes, Simple crystal structures of sc, bcc, fcc, hcp, Reciprocal lattice, Brillouin zones, Diffraction of x-rays by crystals, Bragg's law, Bragg's spectrometer

Unit-2: Electrical Properties of Materials

Elementary band theory of solids, Bloch theorem, Kronig-Penney model, Effective mass of electron, Concept of holes, Band gap, Energy band diagram and classification of solids

Unit-3: Magnetic Properties of Matter

Dia, para, ferro, ferri, & antiferro-magnetic materials, Langevin's theory of diamagnetism, Curie's law, Discussion of B-H curve, Hysteresis and energy loss

Unit-4: Superconductivity

Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Type I and Type II superconductors, Temperature dependence of critical field, London's Equation and Penetration Depth, Idea of BCS theory (Qualitative), Applications of Super-conductors.

Text and Reference Books

Text Book:

1. Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley and Sons, Inc.
2. A J Dekkar, Solid State Physics, Macmillan India Limited, 2000.
3. S.O. Pillai, Solid State Physics, New Age International, 2015.

Reference Books:

1. J. S. Blackmore, Solid State Physics, Cambridge University Press, Cambridge.
2. N. W. Ashcroft and N. D. Mermin, Solid State Physics, Harcourt Asia, Singapore, 2003
3. M. Ali Omar, Elementary Solid State Physics: Principles and Applications, Pearson Education, 1999
4. J.P. Srivastava, Elements of Solid State Physics, Prentice Hall Of India, 2004.
5. Puri and Babbar, "Solid State Physics" (S. Chand).

Course Outcomes:

After completing the course, students will be able to achieve the following:

CO1	To define the structure of different types of materials; amorphous, crystalline and superconductors
CO2	To explain the basic methods used for the structural analysis of materials. and properties of superconductors
CO3	To apply different methods for solving numerical problems on structural determination.
CO4	To critically analyse the behaviour of structural changes on the properties of the materials. Analysis of electrical and magnetic properties of matter.
CO5	To evaluate the structure of materials using different experimental techniques such as x-ray diffraction and electron microscopy. Low temperature behavior of conductivity.
CO6	To gain knowledge of condensed matter physics and create their own discretion for finding new structure-specific application of various materials and superconductor applications.

DSE-6P SOLID STATE ELECTRONIC DEVICES

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Circuit fundamentals, Mathematical Physics

Course Objectives:

1. To give an overview of Bipolar junction and field effect transistors, MOSFET and optoelectronic devices.
2. To give complete knowledge of working and properties of above devices and their biasing.
3. To describe voltage controlled unipolar or bipolar, characteristics of JFET, Drain Characteristics, effect of Gate to source voltage on drain characteristics, transfer characteristics, Formation of Depletion region in JFET, operation of JFET
4. To explain the Advantages of JFET over BJT, Disadvantage of JFET. Basic Construction, Working operation, Static characteristic: Drain characteristic, transfer characteristic of MOSFETs. Photo detectors and optoelectronic devices. LED, varactor and Schottky diode.
5. To organize the knowledge of MOSFET for comparison, and classification and use as amplifier.
6. To develop the Applications of JFET, MOSFET and photodetectors., LED, Schottky and Varactor diodes.

Detailed Syllabus

Unit-1: Semiconductor Diode

Introduction, Intrinsic and extrinsic semiconductors, variation of resistivity with temperature. Fermi level. p-n junction diode, I-V characteristics, Zener diode and its applications

Unit-2: Bipolar Junction Transistor

BJT:Junction transistor construction, transistor symbols, unbiased transistor, biasing of a transistor, the working of a transistor. characteristics in CB, CE, CC modes. Single stage amplifier, two stage R-C coupled amplifiers. Simple Oscillators: Barkhausen condition, sinusoidal oscillators. OPAMP and applications: Inverting and non-inverting amplifier.

Unit-3: Field Effect Transistor: JFET and MOSFET

JFET: Introduction, Junction field effect transistor (JFET): symbol for JFET, voltage controlled unipolar or bipolar, characteristics of JFET, Drain Characteristics, effect of Gate to source voltage on drain characteristics, transfer characteristics, Advantages of JFET over BJT, Disadvantage of JFET, Formation of Depletion region in JFET, operation of JFET, Summary of various features of JFET, application of JFET.

MOSFET: Depletion-type MOSFETs: Basic Construction, Working operation, Static characteristic: Drain characteristic, transfer characteristic, circuit symbol, Applications. The MOSFET as an Amplifier, advantages of N-channel MOSFETs over P-Channel MOSFET, Comparison of JFET and MOSFET. Biasing of depletion type MOSFETs, Common source amplifier. Enhancements type MOSFETs: Basic Construction, Static characteristic, Applications.

Unit-4: Optoelectronic Devcies

Photodiodes-Current and Voltage in illuminated Junction, Photo detectors-Noise and Bandwidth of Photo detectors.Light emitting diode (LED): Voltage drop and current characteristics, Electrical and the Optical parameter, Advantages and disadvantages of LED.Schottky Diode: Construction and working, high frequency switching operations and Applications. Varactor Diode: Specifications of varactor Diode, Applications.

Unit-5: Boolean Algebra

Binary number systems; conversion from one system to another system; binary addition and subtraction. Logic Gates AND, OR, NOT, NAND, NOR exclusive OR; Truth tables; combination of gates; de Morgan's theorem.

Text and Reference Books

Text Book:

1. Ben. G. Streetman & Sanjan Banerjee Solid State Electronic Devices (5th Edition) PHI Private Ltd, 2003.
2. Robert Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, 8Th Edition, Pearson Education, India, 2004.

Reference Books:

1. YannisTsividis: Operation & Mode line of The MOS Transistor (2nd Edition) Oxford University Press, 1999
2. Nandita Das Gupta &Aamitava Das Gupta- Semiconductor Devices Modeling a technology, PHI, 2004.

Course Outcomes:

After completing the course, students will be able to achieve the following:

CO1	To define the different types of junction transistor devices and the various terms involved.
CO2	To describe the construction and working of UJT, BJT, JFET, MOSFET (n-channel and p-channel), LED, Schottky and varactor diodes.
CO3	To apply above knowledge in solving numerical problems on working and parameters of above devices.
CO4	To analyze the behavior of these devices under different biasing conditions and classify them
CO5	To evaluate Drain Characteristics, effect of Gate to source voltage on drain characteristics, transfer characteristics, Advantages of JFET over BJT, Disadvantage of JFET, Formation of Depletion region in JFET, operation of JFET.
CO6	To evolve and analyse Drain characteristic, transfer characteristic, & Applications of MOSFET and high frequency switching applications.

CPR551: PHYSICS LAB-V

Teaching Scheme	Examination Scheme
Lectures: 0 hrs/Week	Attendance – 5 Marks
Tutorials: 0 hr/Week	Teachers Assessment – 10 Marks
Practicals: 4 hr/Week	Class Test -- 0 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite: Handling of more advanced instruments, setting up delicate and sensitive arrangements and calibration of certain experimental setups, CPR251.

Course Objectives:

1. To give an overview of the experiment equipment and underlying principles.
2. To give complete knowledge of handling of instrument and making correct measurements
3. To describe the method of making calculations and plotting graphs & interpret them**.**
4. To explain the various possible causes of error and their removal.
5. To organize the result and make further use in understanding and problem solving.
6. To create new experimental setups for related extended and advanced measurements.

Detailed Syllabus

List of Experiments

1. To verify Stefan's law & determine the value of Stefan's Constant.
2. To study the Characteristics of a Photo-diode.
3. To verify inverse square law for light using a photocell as a photometer.
4. To determine the ionization potential of the given gas (Xenon).
5. To compare the illuminating powers of two given bulbs by means of a photo cell.
6. To determine the absorption coefficient of the given liquid (or solution) with the help of a photo cell.
7. Characteristic curves of a photo electric cell and determination of stopping potential.
8. To study the PE Hysteresis loop of a Ferroelectric Crystal.
9. To measure the Magnetic susceptibility of Solids and Liquids.
10. To determine a Low Resistance by Carey Foster's Bridge.
11. To determine a Low Resistance by a Potentiometer.

Note: Student has to perform any eight experiments;

Reference Books:

1. Geeta Sanon, B. Sc. Practical Physics, 1st Edn. (2007), R. Chand & Co
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi
3. Indu Prakash and Ramakrishna, A Text Book of Practical Physics Vol 1 &Vol 2, Kitab Mahal, New Delhi
4. D.P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes,Vani Publication House, New Delhi.

Course Outcomes:

After completing the course, students will be able to achieve the following:

CO1	To handle laboratory instruments and make precise measurements
CO2	To be able to align and setup the instrument for performing the experiment.
CO3	To be able to diagnose any errors in arrangement
CO4	To analyze the observations by calculating the related physical quantities and verify the underlying law of Physics.
CO5	To evaluate the percentage and maximum probable error and minimizing error.
CO6	To design improvised extensions of related experiments.

CPR651: PHYSICS LAB-VI

Teaching Scheme	Examination Scheme
Lectures: 0 hrs/Week	Attendance – 5 Marks
Tutorials: 0 hr/Week	Teachers Assessment – 10 Marks
Practicals: 4 hr/Week	Class Test -- 0 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite:Handling of more advanced instruments, setting up delicate and sensitive arrangements and calibration of certain experimental setups, CPR251.

Course Objectives:

1. To give an overview of the experiment equipment and underlying principles.
2. To give complete knowledge of handling of instrument and making correct measurements
3. To describe the method of making calculations and plotting graphs & interpret them**.**
4. To explain the various possible causes of error and their removal.
5. To organize the result and make further use in understanding and problem solving.
6. To create new experimental setups for related extended and advanced measurements.

Detailed Syllabus

List of Experiments

1. Study The characteristics (FET)
2. Study The characteristics Metal Oxide Semiconductor Field Effect Transistor (MOSFET)
3. To design an Inverting Amplifier of given gain using Op-amp 741 and to study its Frequency Response.
4. To design a Non-Inverting Amplifier of given gain using Op-amp 741 and to study its Frequency Response.
5. To design and study a precision Differential Amplifier of given I/O specification using Op-amp 741.
6. To design an Astable Multivibrator of given specifications using 555 Timer.
7. To determine the coefficient of thermal conductivity of a bad conductor by lee and charlton's disc method.
8. To determine the value of e/m of an electron by helical (long solenoid) method.
9. To determine the value of Boltzmann Constant by studying Forward Characteristics of a Diode.
10. To study Hall effect and to calculate (i) Hall coefficient and (ii) Concentration of charge carrier
11. To determine the half-life period of given radioactive source using a G. M. counter.

Note:Student has to perform any eight experiments;

Reference Books:

1. Geeta Sanon, B. Sc. Practical Physics, 1st Edn. (2007), R. Chand & Co
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi
3. Indu Prakash and Ramakrishna, A Text Book of Practical Physics Vol 1 &Vol 2, Kitab Mahal, New Delhi
4. D.P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes,Vani Publication House, New Delhi.

Course Outcomes:

After completing the course, students will be able to achieve the following:

CO1	To handle laboratory instruments and make precise measurements with sophisticated instruments.
CO2	To be able to align and setup the instrument for performing the experiment.
CO3	To be able to diagnose any errors in arrangement and make improvements.
CO4	To analyze the observations by calculating the related physical quantities and verify the underlying law of Physics.
CO5	To evaluate the percentage and maximum probable error and minimizing error and implement methods to achieve optimum precision.
CO6	To design improvised extensions of related and new experiments.

DSE – CHEMISTRY
DSE-1C APPLIED ORGANIC CHEMISTRY

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of alkene, carbonyl compound, heterocyclic, carbohydrates and organometallic compounds.

Course Objectives:

1. To know about alkene Stereoisomers: (E)-2-Butene and (Z)-2-Butene.
2. To understand the more than One C=C in a Molecule.
3. To learn the alkenes with OH or NH_2 Groups.
4. To learn the acidity of C≡C-H Hydrogens.
5. To know the mechanisms of Aldol condensation.
6. To understand the aromatic characteristics of pyrrole.

Detailed Syllabus

Unit-1: Chemistry of Alkenes and alkynes

Alkenes: Ethene, Propene, 1-Butene, 2-Butene and other Alkenes and Cycloalkenes. Alkene Stereoisomers: (E)-2-Butene and (Z)-2-Butene. E,Z Assignment Rules. E and Z Stereoisomers are Diastereomers. cis and trans Isomers. More than One C=C in a Molecule, Polyenes. Allenes. Nomenclature of Substituted Alkenes, Alkyl and Halogen Substituted Alkenes. Alkenes with OH or NH_2 Groups. Relative Stability of Isomeric E and Z Alkenes.

Alkynes: Nomenclature, Alkyne Structure, Alkyne Stability. Acidity of C≡C-H Hydrogens

Allenes: Nomenclature, Structure, Bonding and Bond Lengths.

Unit-2: Chemistry of Carbonyl Compounds:

Structure, reactivity and preparation; Mechanisms of Aldol condensation, Cannizzaro reaction, Haloform reaction and Beckmann rearrangement

Unit-3: Hetrocyclic Compounds:

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine, Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution, Mechanism of nucleophilic substitution reaction in pyridine derivatives, Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six membered heterocycles, Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, and Skraup synthesis. Mechanism of electrophilc substitution reactions of indole, quinoline and isoquinoline.

Unit-4: Bioorganic Chemistry

Carbohydrates: Classification and nomenclature, Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, Configuration of monosaccharides, Erythro and threodiastereomers, Conversion of glucose intro mannose, Formation of glcosides, ethers and esters,

Determination of ring size of monosaccharides, Cyclic structure of D(+)-glucose, Mechanism of mutarotation. Structures of ribose and deoxyribose, An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Unit-5: Organometallic Compounds

Preparation, properties and important reactions of Oragnomagnesium, organozinc, Organolithium compounds.

Text and Reference Books

Reference Books:

1. *"Organic Chemistry",* R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hallof India (P) Ltd., New Delhi.
2. *"Organic Chemistry"*,S. M. Mukherji , S. P. Singh, and R. P. Kapoor, 1st Edition(1985), 5th Reprint (1999), New Age International (P) Ltd.Publishers, New Delhi.
3. *"Organic Chemistry – Structure and Reactivity",* Seyhan N. Ege, AITBS publishers,Delhi (1998).
4. *"Organic Chemistry",* Paula Y. Bruice, 2nd Edition , Prentice-Hall InternattionalInc,New Jersey, International Edition (1998).

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the cannizzaro reaction, Haloform reaction and Beckmann rearrangement.
CO2	Understand the alkyne Stability.
CO3	Explain the important reactions of oragnomagnesium.
CO4	Develop the disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose)
CO5	Calculate the quinoline and isoquinoline with special reference to Fisher indole synthesis
CO6	Illustrate the E and Z Stereoisomers are Diastereomers.

DSE-2C PHYSICAL CHEMISTRY

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of conductivity measurements, chemical kinetics, catalysis and surface chemistry.

Course Objectives:

1. To know about ionic velocities
2. To understand the rate laws in terms of the advancement of a reaction.
3. To learn the consecutive reactions.
4. To learn the acid and base catalysis.
5. To know the applications of colloids.
6. To understand the Fermi golden rule.

Detailed Syllabus:

Unit-1: Applications of conductivity measurements:

Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods. Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water.

Unit-2: Chemical Kinetics:

Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions first & second order reactions, Temperature dependence of reaction rates; Arrhenius equation; activation energy.

Reversible (first order in both directions), consecutive reactions. Unimolecular gas reactions (Lindemann theory), steady-state approximations, theory of absolute reaction rate and its thermodynamical formulation, temperature dependence of frequency factor.

Unit-3: Catalysis:

Definition of catalysis, mechanisms of catalysis, acid and base catalysis, general and specific catalysis, Enzyme catalysis.

Unit-4: Surface Chemistry

Adsorption- Langmuir and Freundlich isotherms. Sols (reversible and irreversible), emulsions and emulsifiers, association colloids (micelles), gels. Applications of colloids.

Unit-5: Molecular Spectroscopy

introduction to spectroscopy, electromagnetic radiation, Heisenberg Uncertainty principle, Spectral intensity, linewidth, position, Einstein coefficients, Fermi golden rule. Brief introduction to rotational and vibrational spectroscopy.

Text and Reference Books

Reference Books:

1. Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry* 8th Ed., Oxford University Press (2006).
2. Ball, D. W. *Physical Chemistry* Thomson Press, India (2007).
3. Castellan, G. W. *Physical Chemistry* 4th Ed. Narosa (2004).

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the degree of dissociation of weak electrolytes.
CO2	Understand the temperature dependence of reaction rates.
CO3	Explain the unimolecular gas reactions (Lindemann theory).
CO4	Develop the mechanisms of catalysis.
CO5	Calculate the adsorption- Langmuir and Freundlich isotherms.
CO6	Illustrate the electromagnetic radiation.

DSE-3C INORGANIC CHEMISTRY

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of d-block elements, Metal-Ligand Bonding, Electronic Spectra and Bio-inorganic Chemistry.

Course Objectives:

1. To know about coordination complex.
2. To understand the chelates.
3. To learn the Limitations of Valence Bond Theory.
4. To learn the electronic spectra, magnetic properties.
5. To know the metal ethylenic Complexes.
6. To understand the Nature of bonding in metal carbonyls.

Detailed Syllabus:

Unit-1: d-block elements:

General introduction of coordination complex, common shape, EAN rule, classification of ligands in terms of denticity, chelates, isomerism in coordination complex.

Unit-2: Metal-Ligand Bonding, Electronic Spectra and Magnetic Properties in Transition Metal Complexes:

Limitations of Valence Bond Theory, Crystal Field Splitting in Octahedral, Tetrahedral and Square Planar Complexes, d-d transitions, selection rule, electronic spectra, magnetic properties.

Unit-3: Organometallic Chemistry

Organometallic Compounds, Preparation, Properties. A Brief account of metal ethylenic Complexes, Nature of bonding in metal carbonyls, A Brief account of metal-ethylenic Complexes.

Unit-4: Bio-inorganic Chemistry:

Essential and *Tace* elements in biological processes, Metalloporphyrins with special reference to hemoglobin, and myoglobin, Biological role of alkali (Na+, K+) and alkaline earth metal ions(Mg^{2+}, Ca^{o+}). Nitrogen Fixation.

Text and Reference Books

Reference Books:

1. *Concise Inorganic Chemistry",* J. D. Lee, 5th Edition (1996), Chapman & Hall, London.
2. *"Modern Inorganic Chemistry",* R. C. Aggarwal, 1st Edition (1987), KitabMahal, Allahabad.
3. *"Basic Inorganic Chemistry",* F. A Cotton, G. Wilkinson,and Paul L. Gaus, 3rd Edition(1995), John Wiley & Sons, New York.
4. *"Inorganic Chemistry",* A. G. Sharpe, 3rd International Student Edition (1999), ELBS /Longman, U.K.
5. *"Inorganic Chemistry",* D. F. Shriver and P. W. Atkins, 3rd Edition (1999),ELBS, London.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the nitrogen Fixation.
CO2	Understand the metalloporphyrins with special reference to hemoglobin, and myoglobin.
CO3	Explain the metal-ethylenic Complexes.
CO4	Develop the d-d transitions, selection rule.
CO5	Calculate the crystal Field Splitting in Octahedral.
CO6	Illustrate the ligands in terms of denticity.

DSE-4C GREEN CHEMISTRY

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of Green Chemistry and its 12 principles, Green Solvents and Renewable Resources.

Course Objectives:

1. To know about green chemistry and its 12 principles.
2. To understand the environmental factor calculations.
3. To learn the volatile organic compounds.
4. To learn the aqueous solvents.
5. To know the homogenous catalysis.
6. To understand the phase transfer catalysis.

Detailed Syllabus:

Unit-1: Introduction to Green Chemistry:

Green Chemistry and its 12 principles. Concepts of green chemistry. History of Green Chemistry and Sustainability Contributions of Paul Anastas, Roger Sheldon (E-Factor), and Barry Trost (Atom Efficiency). History of Environmental Legislation Process Flow Sheet Development, Environmental Factor Calculations, and Atom Utilization Comparisons.

Unit-2: Green Solvents:

Industrial Applications Volatile Organic Compounds (VOC's).

Unit-3: Benign Solvents:

Industrial uses of , Super Critical Fluids, and Ionic liquids.

Unit-4: Catalysis:

Indusrial catalysis-Organometallics. Homogenous catalysis-Phase Transfer Catalysis (PTC) Hydroformylation Carboynlation Metathesis. Heterogeneous Catalysis- History of Zeolites Zeolite Nomenclature Zeolite Structure Zeolite usage in Menthol synthesis, Caprolactam synthesis, Electophilic Aromatic Substitutions, and the Asahi Process.

Unit-5: Renewable Resources:

Overview of Synthesis and Uses of Biofuels (Ethanol, Biodiesel, and Fuel Cells) .

Unit-6: Consumer Products Derived From Renewal Resources:

Plastics from Plant Oils Lignin-Based Bottles Synthesis and Properties of 2-Methyltetrahydrofuran.

Text and Reference Books

Reference Books:

1. Green Chemistry: Fundamentals and Applications by Suresh C. Ameta, RakshitAmeta, 2013 by Apple Academic Press; ISBN: 9781926895437.
2. Green Chemistry: An Introductory Text: Edition 3 by Mike Lancaster; RSC Publishing House, ISBN: 978-1-78262-294-9.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the properties of 2-Methyltetrahydrofuran.
CO2	Understand the plant oils lignin-based bottles synthesis.
CO3	Explain the structure zeolite usage in menthol synthesis.
CO4	Develop the phase transfer catalysis.
CO5	Calculate the super critical fluids.
CO6	Illustrate the atom utilization comparisons.

DSE-5C INTRODUCTION TO NANOSCIENCE

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of Scientific Revolution-Atomic Structure, Quantum Dots shell structures and Supramolecular aspects in Chemistry.

Course Objectives:

1. To know about emergence and challenges of nanoscience and nanotechnology.
2. To understand the surface effects on the properties.
3. To learn the properties of nanomaterials.
4. To learn the mechanical-physical-chemical properties.
5. To know the micelles and polymers.
6. To understand the hydrolyticenzymes.

Detailed Syllabus:

Unit-1: Background to Nanoscience:

Definition of Nano, Scientific Revolution-Atomic Structure and atomic size, emergence and challenges of nanoscience and nanotechnology, carbon age-new form of carbon (CNT to Graphene), influence of nano over micro/macro, size effects and crystals, large surface to volume ration, surface effects on the properties.

Unit-2: Types of nanostructure and properties of nanomaterials:

One dimensional, Two dimensional and three-dimensional nanostructured materials, Quantum Dots shell structures, metal oxides, semiconductors, composites, mechanical-physical-chemical properties.

Unit-3: Application of Nanomaterial:

Ferroelectric materials, coating, molecular electronics and nanoelectronics, biological and environmental, membrane-based application, polymer-based application.

Unit-4: Supramolecular aspects in Chemistry:

Fundamental understanding, Host-guest complexation chemistry, micelles, polymers, cyclodextrins, functionalization reactions, Introduction to supramolecular catalysis and enzymes, Multifunctional catalysis and simple models, Hydrolyticenzymes.

Text and Reference Books

Reference Books:

1. Chemistry of nanomaterials: Synthesis, properties and applications by CNR Rao et.al
2. Textbook of Nanoscience and Nanotechnology by T. Pradeep, 2012 McGraw Hill Education (India) Private Limited, ISBN: 9781259007323.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the supramolecular catalysis and enzymes.
CO2	Understand the host-guest complexation chemistry.
CO3	Explain the ferroelectric materials, coating, molecular electronics and Nanoelectronics.
CO4	Develop the metal oxides, semiconductors and composites.
CO5	Calculate the influence of nano over micro/macro and size effects.
CO6	Illustrate the emergence and challenges of nanoscience and nanotechnology.

DSE-6C ADVANCED PHYSICAL ORGANIC CHEMISTRY

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of Reaction Mechanisms, Chemical Kinetics to Decipher Reaction Mechanisms and Diagnostic Tools.

Course Objectives:

1. To know about writing reaction mechanisms.
2. To understand the kinetic vs Thermodynamic Control.
3. To learn the distinguishing reaction mechanism using rate laws.
4. To learn the Hammett Plots for electronic effects.
5. To know the secondary kinetic isotope effect.
6. To understand the reaction coordinate diagram.

Detailed Syllabus:

Unit-1: Introduction to Reaction Mechanisms

Writing reaction mechanisms: Arrow pushing; Types of polar reactions; Radical reactions; Reaction coordinate diagram; The Hammond Postulates; The Kinetic vs Thermodynamic Control; Curtin-Hammett control.

Unit-2: Chemical Kinetics to Decipher Reaction Mechanisms

An introduction to reaction kinetics; Deriving the rate laws; Distinguishing reaction mechanism using rate laws; Methods to monitor a reaction.

Unit-3: Diagnostic Tools

The Hammett Equation; Linear Free Energy relationships (LFER); Hammett Plots for electronic effects; Scales used in Hammett Plots; Deviation from Linear energy relationships; Solvents effects; Kinetic isotope effect; Primary kinetic isotope effect; Secondary kinetic isotope effect; Isotope labeling; Trapping of Intermediates.

Unit-4: Catalysis

Enzyme catalysis; Electrophilic catalysis; Other types of catalysis.

Text and Reference Books

Reference Books:

1. Determination of Organic Reaction Mechanisms by Barry K. Carpenter; David O. Carpenter, ISBN: 0471893692.
2. Kinetics and Mechanism by John W. Moore; Ralph G. Pearson, ISBN: 0471035580.
3. Physical Organic Chemistry by C. A. Ritchie, ISBN: 0824783077.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the polar reactions and radical reactions.
CO2	Understand the kinetic vs thermodynamic control.
CO3	Explain the Hammond postulates.
CO4	Develop the pprimary kinetic isotope effect.
CO5	Calculate the linear energy relationships.
CO6	Illustrate the reaction mechanisms.

(DSE-P) CSR551: PHYSICAL ORGANIC CHEMISTRY LAB

Teaching Scheme	Examination Scheme
Lectures: 0 hrs/Week	Attendance – 5 Marks
Tutorials: 0 hr/Week	Teachers Assessment – 10 Marks
Practicals: 4 hr/Week	Class Test -- 0 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite: To develop skills for the physical organic experiments.

Course Objectives:

1. To know about rate constant of ester hydrolysis reaction.
2. To understand the chemical kinetics.
3. To learn the pseudo first order condition.

Detailed Syllabus:

List of Experiments

1. Determination of rate constant of ester hydrolysis reaction under pseudo first order condition.
2. Measuring UV-visible spectrum of iodine in polar and non-polar solvent.
3. Constructing Erying plot for ester hydrolysis.
4. Distinguishing S_N1 and S_N2 using chemical kinetics.
5. Construction of Hammett plot for a standard reaction.

Text and Reference Books

Reference Books:

1. Practical Physical Chemistry by B. Vishwanathan, P.S. Raghavan.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the determination of rate constant of ester hydrolysis reaction
CO2	Understand the measuring UV-visible spectrum.
CO3	Explain the iodine in polar and non-polar solvent.
CO4	Develop the distinguishing S_N1 and S_N2 using chemical kinetics.
CO5	Calculate the construction of Hammett plot for a standard reaction.
CO6	Illustrate the pseudo first order reaction.

(DSE-P) CSR551: ORGANIC CHEMISTRY LAB

Teaching Scheme	Examination Scheme
Lectures: 0 hrs/Week	Attendance – 5 Marks
Tutorials: 0 hr/Week	Teachers Assessment – 10 Marks
Practicals: 4 hr/Week	Class Test -- 0 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite: To develop skills for the organic experiments.

Course Objectives:

1. To know about primary, secondary and tertiary amines
2. To understand the qualitative analysis of unknown organic compounds.
3. To learn the preparation of Picric acid.

Detailed Syllabus:

List of Experiments

1. Qualitative analysis of following types of unknown organic compounds:
   - I. Carbohydrates
   - II. Primary, secondary and tertiary amines
   - III. Nitro compounds
   - IV. Amides
   - V. Aryl halides
2. Preparation of following organic compounds:
   - I. Acetanilide
   - II. Picric acid
   - III. Aspirin

Note: Experiments may be added/deleted subject to availability of time and facilities

Text and Reference Books

Reference Books:

1. Bansal, R. K, (2008). Laboratory Manual of Organic Chemistry (IV Edition). New Delhi: New Age, Publishers.
2. 3.Arun Sethi, (2003). Laboratory experiments in Organic Chemistry. New Delhi: New Age Publisher.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Apply the various techniques of preparation and analysis of organic substances
CO2	Understand the techniques involving drying and recrystalliation by various method
CO3	Do two stage preparation involving molecular rearrangement and well known organic reactions.
CO4	Do the pilot separation of bimixtures and familiarize the systematic procedure of organic substances analysis
CO5	Calculate a limiting reagent, yield, and percent yield
CO6	Evaluate collected data to determine the identity, purity, and yield of products

CSR651: PHYSICAL CHEMISTRY LAB

Teaching Scheme	Examination Scheme
Lectures: 0 hrs/Week	Attendance – 5 Marks
Tutorials: 0 hr/Week	Teachers Assessment – 10 Marks
Practicals: 4 hr/Week	Class Test -- 0 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite: To develop practical skills for physical chemistry experiments.

Course Objectives:

1. To know about Surface tension-composition curve for a binary liquid mixture.
2. To understand the Beer's Law - Determination of concentration of solution by colorimetry.
3. To learn the Equilibrium constant of methyl acetate hydrolysis reaction.

Detailed Syllabus:

List of Experiments

1. Viscosity-composition curve for a binary liquid mixture.
2. Surface tension-composition curve for a binary liquid mixture.
3. Determination of indicator constant - colorimetry.
4. Determination of pH of a given solution using glass electrode.
5. Beer's Law - Determination of concentration of solution by colorimetry.
6. Order of reaction of I_2 / Acetone / H^+.
7. Equilibrium constant of methyl acetate hydrolysis reaction.
8. Dissociation constants of weak acid, base.
9. Conductometrictitration : acid-base.
10. Potentiometric titration : acid-base.
11. Kinetics of catalytic decomposition of H_2O_2.
12. Kinetics of acid-catalysed hydrolysis of sugar (chemical method).

Text and Reference Books

Reference Books:

1. Palit, S.R., Practical Physical Chemistry Science Book Agency
2. Mukherjee, N.G., Selected Experiments in Physical Chemistry J. N. Ghose & Sons

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the viscosity-composition curve for a binary liquid mixture.
CO2	Understand the indicator constant – colorimetry.
CO3	Explain the pH of a given solution using glass electrode.
CO4	Describe the kinetics of catalytic decomposition of H_2O_2.
CO5	Calculate the equilibrium constant of methyl acetate hydrolysis reaction.
CO6	Illustrate the kinetics of acid-catalysed hydrolysis of sugar

CSR652: INORGANIC CHEMISTRY LAB

Teaching Scheme	Examination Scheme
Lectures: 0 hrs/Week	Attendance – 5 Marks
Tutorials: 0 hr/Week	Teachers Assessment – 10 Marks
Practicals: 4 hr/Week	Class Test -- 0 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite: Develop the skills for inorganic chemistry experiments.

Course Objectives:

1. Learned about the conductance of the complexes with that of M/1000.
2. Learned the preparation of inorganic complexes.
3. Learnt the estimation metals in a mixture by volumetric and gravimetric analysis.

Detailed Syllabus:

List of Experiments

1. Preparation of any two of the following complexes and measurement of their conductivity:
   (i) tetraamminecarbonatocobalt (III) nitrate
   (ii) tetraamminecopper (II) sulphate
   iii) potassium trioxalatoferrate (III) trihydrate
   iv) other inorganic complexes.
2. Compare the conductance of the complexes with that of M/1000 solution of NaCl, $MgCl_2$ and $LiCl_3$ and other compounds.
3. Iodimetric estimation of ascorbic acid in fruit juices.
4. Estimation of dissolved oxygen in water samples.
5. Gravimetric estimation of sulphate as barium sulphate

Text and Reference Books

Reference Books:

1. Ramanujam, V. V. (2004). Inorganic Semi-micro Qualitative Analysis (III Edition). Chennai: The National Publishing Company.
2. Venkateswaran, V., Veeraswamy, R., & Kulandaivelu, A. R. (2004). Basic Principles of Practical Chemistry (II Edition). New Delhi: S. Chand Publications.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Gained the knowledge about maintain high standards of professional and scientific ethics.
CO2	Known about the chromatographic separation techniques.
CO3	Explain the preparation of coordination complexes and their mechanisms.
CO4	Explain the importance of the volumetric and gravimetric analysis of cations and anions.
CO5	Calculate the number of ions present in the solution.
CO6	Illustrate the various complex preparation.

DSE - MATHEMATICS
DSE-1M ELEMENTARY OPTIMIZATION AND NUMERICAL TECHNIQUES

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Introduction of Operation Research and numerical analysis

Course Objectives:
1. To impart knowledge in concepts and tools of Operations Research.
2. To understand the mathematical tools that are needed to solve optimisation problems.
3. To convert the problem into a mathematical model.
4. To develop a report that describes the model and the solving technique, analyse the results and propose recommendations .

Detailed Syllabus:

Unit-1

Introduction of Operation Research, Statement and formation of general linear programming problems, Graphical method, Simplex method, Duality in linear programming problems, Dual simplex method, Primal-dual method, Transportation problems, Assignment problems, Game Theory.

Unit-2

Solution of transcendental and polynomial equations by iteration, bisection, Regula-Falsi and Newton-Raphson methods.

Unit-3

Operators and their relationships, Fundamental theorem of difference calculus, Interpolation, Newton-Gregory's forward and backward interpolation formulae.

Divided differences, Newton's divided difference formula, Lagrange's interpolation formula, Numerical differentiation.

Unit-4

Numerical integration, General quadrature formula, Trapezoidal and Simpson's rules, Numerical solution of first order differential equations: Euler's method, Picard's method, Runge-Kutta method

Text and Reference Books

1. Francis Scheid, Numerical Analysis, TMH New Delhi.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005
3. E.Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
4. Wayne L. Winston,"Operations Research" Thomson Learning,2003.
5. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education,2003.
6. R. PanneerSeevam, "Operations Research" PHI Learning, 2008.
7. V.K.Khanna, "Total Quality Management" New Age International, 2008

COURSE OUTCOMES:

After completing the course, students will be able to:

CO1	To define or describe all the introductory level of linear programming problem, Big-M method, Duality, Transportation problem, Assignment problem, Integer programming
CO2	To understand the basic methods or theorems required for the study of linear programming problem, Big-M method, Duality, Transportation problem, Assignment problem, Integer programming
CO3	To analyse the behaviour of linear programming problem
CO4	To Evaluate Simplex method, , Big-M method, formulation of the dual problem, Vogel approximation, Northwest-corner method ,least cost method, Hungarian method, Dual Simplex method, Prime Dual method, graphical solution
CO5	To classify all the Numerical Method.

DSE-2M PROBABILITY AND STATISTICS

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/Week	Attendance – 20 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 10 Marks
Practicals: 0 hr/Week	Class Test -- 20 Marks
Credits: 6	End Semester Exam – 100 marks

Prerequisite: Intermediate level probability and statistics.

Course objectives:

1. To explain the theoretical concept of probability and various laws of probability.
2. To understand the meaning of conditional probability, conditioning and reduced sample space.
3. To represent joint distribution of multiple random variables.
4. To identify important types of distributions such as binomial, Poission, geometric etc.
5. To explain conditional expectations extending to correlation and linear regression for two variables.

Detailed Syllabus:

Unit-1

Sample space, probability axioms, Laws of Probability, Conditional Probability, Baye's Theorem, real random variables (discrete and continuous).

Unit-2

Cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, geometric, negative binomial.

Unit-3

Continuous distributions: uniform, normal, exponential

Unit-4

Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables.

Unit-5

Conditional expectations, independent random variables, bivariate normal distribution, correlation coefficient, linear regression for two variables.

Text and Reference Books

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, *Introduction to MathematicalStatistics*, Pearson Education, Asia, 2007.
2. Irwin Miller and Marylees Miller, *John E. Freund'sMathematical Statistics withApplications* (7th Edition), Pearson Education, Asia, 2006.
3. Sheldon Ross, *Introduction to Probability Models* (9th Edition), Academic Press, Indian Reprint, 2007.
4. Alexander M. Mood, Franklin A. Graybill and Duane C. Boes, *Introduction to the Theoryof Statistics*, (3rdEdition), Tata McGraw- Hill, Reprint 2007

COURSE OUTCOMES:

After completing the course, students will be able to:

CO1	To define or describe sample space probability axioms, law of probability, conditional probability, baye's theorem, real random variables, cumulative distribution function.
CO2	To understand probability mass/density function, mathematical expectation, moments, continuous distributions.
CO3	To apply the different methods or theorem to solve the Questions.
CO4	To analyse the characteristic functions, distribution function and its properties.
CO5	To Evaluate the joint probability density functions, passion geometric, negative binomial, marginal and conditional distributions.
CO6	To classify all the solutions of conditional expectations independent random variables.

DSE-3M ALGEBRA

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Introduction of functions and Group theory

Course Objectives:

1. Present the relationships between abstract algebraic structures with familiar numbers systems such as the integers and real numbers.
2. Present concepts of and the relationships between operations satisfying various properties (e.g. commutative property).
3. Present concepts and properties of various algebraic structures.
4. To discuss the importance of algebraic properties relative to working within various number systems.
5. To develop the ability to form and evaluate conjectures.

Detailed Syllabus:

Unit-1

Sets, Relations, Functions and their types, Algebraic Structure, Equivalence relations and partitionsCongruence modulom relation, Algebraic Structure.

Unit-2

Definition of a monoid, groupoid, semi group, group with examples and simple properties, Permutation groups, Subgroups, Centre and normalizer, Cyclic groups,Cosets, Lagrange's theorem. Homomorphism and isomorphism, Introduction to rings, subrings, integral domains, Division Ring and Field with examples.

Text and Reference Books

1. **Joseph A. Gallian**, Contemporary Abstract Algebra (4th Edition), Narosa Publishing House, New Delhi, 1999
2. **.I. N. Herstein ,**Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1975**.**

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand the importance of algebraic properties with regard to working within various number systems.
CO2	Extend group structure to finite permutation groups.

DSE-4M MATHEMATICAL ANALYSIS

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basics idea on open closed set and uniform continuity

Course Objectives:

1. To work with infinite sequences and series.
2. To work with infinite sequence is bounded.
3. To work with an infinite sequence is monotonic.
4. To work with an infinite sequence is convergent or divergent.
5. To Define the real numbers, least upper bounds, and the triangle inequality.
6. To Calculate the limit superior, limit inferior, and the limit of a sequence. rs.
7. Define limit and continuity of an function
8. expansion of an function in two variable

Detailed Syllabus:

Unit-1

Analysis: Real Numbers and its property, Open, closed Intervals, Boundedness, Least upper bound, Greatest Lowerbound, Sequence, Series, and its convergence (basic idea), Convergence of infinite series, Comparison test,ratio test, root test, Limits, continuity and differentiability (on Interval and Sets) of functions, Algebra of continuous and differentiable functions, Various mean value theorems.

Unit-2

Introduction of Uniform continuity, uniform continuity theorem, Absolute Continuity, difference among all type of continuity with counter examples.

Functions of several variable, Limit, continuity and differentiability of functions of several variable, Partial derivatives of Higher orders concept of extrema, implicit and explicit functions, Taylor's theorem, change of variable,

Text and Reference Books

1. **Sudhir R. Ghorpade** and **Balmohan V. Limaye**, A Course in Calculus and Real Analysis, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2006.
2. **R. G. Bartle** and **D. R. Sherbert**, Introduction to Real Analysis(3rd Edition), John Wiley and Sons (Asia) Pte. Ltd., Singapore, 2002.
3. **S.C. Malik and Shanti Arora**, Mathematical Analysis, New Age Publication.
4. **Shanti Narayan**, Elements of Real Analysis, S. Chand & Company, New Delhi

Course Outcomes:

After completing the course, students will be able to:

CO1	Determine if an infinite sequence is bounded.
CO2	Determine if an infinite sequence is monotonic.
CO3	Determine if an infinite sequence is convergent or divergent.
CO4	Determine if an infinite series is convergent or divergent by selecting the appropriate test from the following: (a) test for divergence; (b) integral test; (c) p-series test; (d) the comparison tests; (e) ratio test; and (f) root test.
CO5	Describe fundamental properties of the real numbers that lead to the formal development of real analysis.
CO6	Demonstrate an understanding of limits and how they are used in sequences, series, differentiation and integration.
CO7	Understand the importance of algebraic properties with regard to working within various number systems.
CO8	Extend group structure to finite permutation groups.

DSE-5M DISCRETE MATHEMATICS

Teaching Scheme	Examination Scheme
Lectures: 5 hrs/Week	Attendance – 20 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 10 Marks
Practicals: 0 hr/Week	Class Test -- 20 Marks
Credits: 6	End Semester Exam – 100 marks

Prerequisite: Mathematical reasoning, Boolean algebras,Paradoxes in set theory

Course Objectives:

1. To introduce the concepts of lattices, Boolean algebras, switching circuits and graph theory.
2. To provide some important applications of Boolean algebra and graph theory in real life situations through switching circuits and shortest path algorithms.

Detailed Syllabus:

Unit-1

Mathematical reasoning; propositions; negation disjunction and conjuction; implication and equivalence; truth tables; predicates; quantifiers; natural deduction; rules of Inference; methods of proofs; use in program proving; resolution principle; application to PROLOG. Set theory; Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle, lattices as ordered sets, lattices as algebraic structures, sub lattices, products and homomorphism, properties of modular and distributive lattices,

Unit-2

Boolean algebras, Booleanpolynomials, minimal forms of Boolean polynomials, Quinn-McCluskey method, Karnaugh diagrams,switching circuits and applications of switching circuits.

Unit-3

Paradoxes in set theory; inductive definition of sets and proof by induction;Peono postulates; pigeonhole principle; recursive function theory.

Unit-4

Graph Theory-Relations;properties of relations;equivalence relations and partitions; Partial orderings; Posets; Linear and well-ordered sets; representation of relations by graphs; elements of graph theory, Euler graph, Hamiltonian path, trees, tree traversals, spanning trees.pseudographs, complete graphs, bi-partite graphs,isomorphism of graphs, paths and circuits, Eulerian circuits, Hamiltonian cycles, the adjacency matrix,weighted graph, travelling salesman's problem, shortest path, Dijkstra's algorithm, Floyd-Warshallalgorithm. .

Unit-5

Elementary combinatorics; counting techniques; recurrence relation; generating functions;

Text Books

1. C.L.Liu, Elements of Discrete Mathematics, second edition 1985, McGraw-Hill Book Company. Reprinted 2000.
2. K.H.Rosen, Discrete Mathematics and applications, fifth edition 2003, TataMcGraw Hill publishing Company.

Reference Books:

1. **B A. Davey** and **H. A. Priestley**, Introduction to Lattices and Order, Cambridge University

Press,Cambridge, 1990.
2. **Edgar G. Goodaire** and **Michael M. Parmenter**, Discrete Mathematics with Graph Theory (2nd Edition),Pearson Education (Singapore) Pte. Ltd., Indian Reprint 2003.
3. **Rudolf Lidl** and **Günter Pilz**, Applied Abstract Algebra (2nd Edition), Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand various properties of Lattices and their types.
CO2	Explain the basic concepts of Boolean algebra, switching circuits and their applications.
CO3	Explain the basic concepts of Graphs, their types and its applications in study of shortest path algorithms.

DSE-6M STATICS AND DYNAMICS

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Motion and work, laws of gravity.

Course Objectives:

1. To demonstrate the application of vectors for the analysis of static equilibrium.
2. To explain virtual work and its application in real life.
3. To demonstrate an understanding of the principles of kinematics and kinetics of particles and planar rigid bodies
4. To explain the the principles of kinematics and kinetics of particles.

Detailed Syllabus:

Unit-1

Analytic condition of equilibrium for coplanar forces. Equation of the resultant force.

Unit-2

Common catenary, Centre of gravity, Virtual work. Wrenches, Null line and null plane.

Unit-3

Rotation of a vector in a plane. Radial and transverse velocity & acceleration, Tangential and Normal velocity and acceleration

Unit-4

Simple harmonic motion, Motion under other laws of forces, Earth attraction, Motion in resisting medium

Unit-5

Central orbits and Motion of a particle in three dimensions Kepler's laws of motion..

Text and Reference Books

1. R.S. Verma - A Text Book on Statics,Pothishala Pvt. Ltd., Allahabad.
2. S.L. Loney - An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies, Kalyani Publishers, New Delhi.
3. J.L. Synge & B.A. Griffith - Principles of Mechanics, Tata McGraw-Hill,1959.

Course Outcomes:

After completing the course, students will be able to:

1	To define or describe all the introductory level of Force, Common catenary, Centre of gravity, Wrenches, Rotation of vector in a plane, Null line and Null plane.
2	To understand the basic methods or theorems required for the study of Analytic condition of equilibrium for coplanar forces, Virtual work, Simple Harmonic Motion, Keepler's law of motion.
3	To analyze the behavior of Rotation of vector in a plane, Motion in resisting medium, Common catenary.
4	To Evaluate the solution of Radial and transverse velocity & acceleration, Tangential and Normal velocity and acceleration.
5	To classify the system of Central orbits and Motion of a particle in three dimensions.

CMR551: MATH LAB - I

Teaching Scheme	Examination Scheme
Lectures: 0 hrs/Week	Attendance – 5 Marks
Tutorials: 0 hr/Week	Teachers Assessment – 10 Marks
Practicals: 4 hr/Week	Class Test -- 0 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite: MATLAB Software

Course Objectives:

1. To know about the matrix operation.
2. To know about the plotting of 2-D and 3-D graphs.
3. To know about the derivatives of function.
4. To know about the complex numbers and their algebra.
5. To know about the solution of simultaneous equations.

Detailed Syllabus:

List of Experiments

1. Modeling of the following problems using*Matlab/ Mathematica/ Maple*etc.
   (i). Plotting of graphs of function e^{ax+b}, $\log(ax+b)$, $1/(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $|ax+b|$ and be able to find the effect of a and b on the graph.
   (ii). Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
   (iii). Matrix operation (addition, multiplication, inverse, transpose), Solution of linear system of equations using matrices.
   (iv). Taylor and Maclaurin series of sin x, cos$x$, log $(1+x)$, e^x, $(1+x)^n$, maxima and minima, inverse of graphs.
   (v). Calculate derivatives of differentiable functions by using functions.
2. Modeling of the following problems using*Matlab/ Mathematica/ Maple*etc.
   (i) Define elementary transformations on matrices.
   (ii) Find the rank of matrices by different ways.
   (iii) Solve system of linear equations by Gauss-Jacobi/Gauss-Seidel/SOR.(for three variables).
   (iv) Plot the solution of ODE of first/Second order.
   (v) Define complex NO's and their algebra (addition, subtraction, multiplication, division etc.)
   (vi) Find modulus and conjugate of complex no's.
   (vii) Define addition and multiplication modulo.

Text and Reference Books

Reference Books:

1. MATLAB programming by PHI,2009.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Matrix operation.
CO2	Plotting of 2-D and 3-D graphs.
CO3	Derivatives of function.
CO4	Complex numbers and their algebra.
CO5	Solution of simultaneous equations.
CO6	Solution of ODE.

CMR651: MATH LAB - II

Teaching Scheme	Examination Scheme
Lectures: 0 hrs/Week	Attendance – 5 Marks
Tutorials: 0 hr/Week	Teachers Assessment – 10 Marks
Practicals: 4 hr/Week	Class Test -- 0 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite: MATLAB Software

Course Objectives:

1. To know about the solution of algebraic and transcendental equation.
2. To know about the Interpolation.
3. To know about the Numerical Integration.
4. To know about the solution of simultaneous equations.

Detailed Syllabus:

List of Experiments

(i) Any two of the following
- (a) Bisection Method
- (b) Newton Raphson Method
- (c) Secant Method
- (d) RegulaFalsi Method

(ii) LU decomposition Method

(iii) Gauss-Jacobi Method

(vi) SOR Method or Gauss-Siedel Method

(v) Lagrange Interpolation or Newton Interpolation

(vi) Simpson's rule

Text and Reference Books

Reference Books:

1. MATLAB programming by PHI,2009.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Solution of algebraic and transcendental equation.
CO2	Solution of Interpolation.
CO3	Solution of Numerical Integration.
CO4	Numerical Differentiation.
CO5	Solution of simultaneous equations.
CO6	Numerical Differential equation.

SEC - SKILL ENHANCEMENT COURSE
SEC-1 CHEMICAL TECHNOLOGY AND SOCIETY

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of Chemical Technology Basic principles and Society Exploration of societal and technological issues from a chemical perspective.

Course Objectives:

1. To know about solvent extraction.
2. To understand the distillation columns.
3. To learn the chemical and scientific literacy.
4. To learn the energy from natural sources.
5. To know the plastics and polymers.
6. To understand the genetic engineering and the manufacture of drugs.

Detailed Syllabus:

Section – A

Unit-1: Chemical Technology Basic principles of distillation, solvent extraction, solid-liquid leaching and liquidliquid extraction, separation by absorption and adsorption.

Unit-2: An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in chemical industry. Introduction to clean technology.

Section – B

Unit-3: Society Exploration of societal and technological issues from a chemical perspective. Chemical and scientific literacy as a means to better understand topics like air and water (and the trace materials found in them that are referred to as pollutants).

Unit-4: energy from natural sources (i.e. solar and renewable forms), from fossil fuels and from nuclear fission; materials like plastics and polymers and their natural analogues, proteins and nucleic acids, and molecular reactivity and interconversions from simple examples like combustion to complex instances like genetic engineering and the manufacture of drugs.

Text and Reference Books

Reference Books:

1. John W. Hill, Terry W. McCreary & Doris K. Kolb, Chemistry for changing times 13th Ed.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the solid-liquid leaching.
CO2	Understand the absorption and adsorption.
CO3	Explain the combustion to complex instance.
CO4	Develop the scaling up operations in chemical industry.
CO5	Calculate the molecular reactivity.
CO6	Illustrate the fossil fuels.

SEC-2 PHARMACEUTICAL CHEMISTRY

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks
Practicals: 0 hr/Week	Class Test -- 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of drugs and pharmaceuticals drug discovery.

Course Objectives:

1. To know about Retrosynthetic approach.
2. To understand the antibacterial.
3. To learn the antiviral agents.
4. To learn the Chloromycetin and Streptomycin.
5. To know the Vitamin C.
6. To understand the analgesics agents.

Detailed Syllabus:

Unit-1:

Drugs & Pharmaceuticals: Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, 112 anti-inflammatory agents (Aspirin, paracetamol, lbuprofen).

Unit-2:

Antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir).

Unit-3:

Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).

Unit-4:

Fermentation Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

Text and Reference Books

Reference Books:

1. G.L. Patrick: Introduction to Medicinal Chemistry, Oxford University Press, UK.
2. Hakishan, V.K. Kapoor: Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Pitampura, New Delhi.
3. William O. Foye, Thomas L., Lemke , David A. William: Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd. New Delhi.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the drugs and pharmaceuticals drug discovery.
CO2	Understand the sulphacetamide, Trimethoprim.
CO3	Explain the production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin.
CO4	Develop the vitamin B2, Vitamin B12.
CO5	Calculate the glutamic acid.
CO6	Illustrate the chloramphenicol.

Human Values & Ethics	
Teaching Scheme Lectures: 2 hrs/Week Tutorials: 0 hr/Week Credits: 2	**Examination Scheme** Class Test -6 Marks Teachers Assessment – 3 Marks Attendance – 6 Marks End Semester Exam – 35 marks

Prerequisite: - Basic requirement for fulfillment of human aspiration.

Course Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

Detailed Syllabus

Unit-1 Need for values education, Self Exploration, Happiness and Prosperity, Basic Features of a good human, life management.
Unit-2 Understanding Harmony in Human Being, Social Health and Concept of Dharma.
Unit-3 Understanding harmony in family and relations, Value of trust and relationship management, Role of religion in human life.
Unit-4 Understanding Harmony in environment, Role of individuals in nation building, Conscious Business.
Unit-5 Comparison of Indian and western view of ethics and values.

Course Outcomes:

After completing the course, students will be able to:

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession.
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Understand the value of harmonious relationship based on trust and respect in their life and profession.
4. Understand the role of a human being in ensuring harmony in society and nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

Entrepreneurship Development	
Teaching Scheme Lectures: 2 hrs/Week Tutorials: 0 hr/Week Credits: 2	**Examination Scheme** Class Test - 6Marks Teachers Assessment - 3Marks Attendance – 6 Marks End Semester Exam – 35 marks

Course Objectives:

1.	Understanding basic concepts in the area of entrepreneurship.
2.	Understanding the role and importance of entrepreneurship for economic development.
3.	Developing personal creativity and entrepreneurial initiative.
4.	Adopting of the key steps in the elaboration of business idea.
5.	Understanding the stages of the entrepreneurial process and the resources needed for the successful development of entrepreneurial ventures.

Detailed Syllabus

Unit-1

Entrepreneurship: Definition of Entrepreneur, Internal and External Factors, Functions of an Entrepreneur, Entrepreneurial motivation and Barriers, Classification of Entrepreneurship, Theory of Entrepreneurship, The entrepreneurial Culture; Stages in entrepreneurial process. Concept of Entrepreneurship-Evolution of Entrepreneurship; Development of Entrepreneurship;

Unit-2

Entrepreneurship and environment-Policies governing entrepreneurs, entrepreneurial development programmes (EDP's) - Institutions for - entrepreneurship development. Problems of EDP's.

.

Unit-3

Entrepreneurial Venture; Idea Generation, Screening and Project Identification, Creative Performance, Feasibility Analysis: Economic, Marketing, Financial and Technical; Project Planning: Evaluation, Monitoring and Control segmentation..

Unit-4

International Entrepreneurship Opportunities: The nature of international entrepreneurship, Importance of international business to the firm, International versus domestics' entrepreneurship, Stages of economic development.

Unit-5

Women entrepreneurship: Need – Growth of women entrepreneurship, Problems faced by women entrepreneurs, prospects.

Unit-6
Entrepreneurship in Informal Sector: Rural Entrepreneurship – Entrepreneurship in Sectors like Agriculture, Tourism, Health Case, Transport & Allied Services.
Text and Reference Books-
1. Entrepreneurship: New Venture Creation, Holt; Prentice-Hall, 1998 2. Entrepreneurship, Dollinger M J; Prentice-Hall, 1999 3. Entrepreneurship, Hisrich; McGraw-Hill Higher Education, 7th edition 4. Dynamics of Entrepreneurship Development, Vasant Desai Himalaya Publications, 11th edition.

Course Outcomes:

1. Appreciate the importance of embarking on self-employment and has developed the confidence and personal skills for the same.
2. Identify business opportunities in chosen sector / sub-sector and plan and market and sell products / services.
3. Consider the legal and financial conditions for starting a business venture.
4. Specify the basic performance indicators of entrepreneurial activity.