INVERTIS UNIVERSITY BAREILLY

CBCS Scheme of Instruction & Syllabi

of

Bachelor of Science

(Physics, Chemistry & Mathematics)

Second 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

15/10/20

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

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

15/10/20

15/10/2020

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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 II B.Sc. (Physics, Chemistry & Mathematics)

S. No.	Category	Course Code	SUBJECT	PERIODS			Evaluation Scheme		Subject Total	Credit
				L	T	P	CA	EE		
III-SEMESTER										
1	DSC-1C	CMR301	Vector Calculus & Elementary Analysis	5	1	0	50	100	150	6
2	DSC-2C	CSR301	Physical Chemistry	3	1	0	30	70	100	4
3	DSC-3C	CPR 301	Electromagnetism	3	1	0	30	70	100	4
4	SEC	CSE301	SEC-1	2	0	0	15	35	50	2
5	DSC-2C(P)	CSR351	Physical Chemistry Lab – III	0	0	4	15	35	50	2
6	DSC-3C(P)	CPR351	Physics (EM)Lab - III	0	0	4	15	35	50	2
			TOTAL	**13**	**3**	**8**	**155**	**345**	**500**	**20**
IV-SEMESTER										
1	DSC-1D	CMR401	Differential Equation	5	1	0	50	100	150	6
2	DSC-2D	CSR401	Inorganic Chemistry	3	1	0	30	70	100	4
3	DSC-3D	CPR 401	Thermodynamics	3	1	0	30	70	100	4
4	SEC	CSE 401	SEC-2	2	0	0	15	35	50	2
5	DSC-2D(P)	CSR 451	Inorganic Chemistry Lab-IV	0	0	4	15	35	50	2
6	DSC-3D(P)	CPR451	Physics (Thermo) Lab - IV	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.**

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

15-10-20

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CPR301 : ELECTROMAGNETISM

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: Basic idea and laws of electricity and magnetism, Lorentz force law, Stokes theorem and Gaauss's divergence theorem, waves and their equation and solution of second order 3-D wave equation

Course Objectives:

1. To give an overview of Electric field, magnetic field and their potentials. To describe the basic laws for calculating fields and forces exerted by them.
2. To give complete knowledge of flux of electric and magnetic field and characteristics of electrostatic field. To explain completely the electromagnetic induction principle and inductance.
3. To apply the above understanding in obtaining electric and magnetic field for various configurations. To obtain direction of emf by Lenz's law.
4. To analyze the energy stored in electric and magnetic field and in configuration of discrete charges.
5. To organize the basic laws to arrive at the electromagnetic wave equation and analyze to obtain their characteristics and Poynting vector.
6. To discuss the behavior of electromagnetic waves in conductors and free space and interpret wave impedance of a medium and its relation with velocity of e.m. wave.

Detailed Syllabus

Unit-1: Electric Field and Potential

Electric field and lines, Potential, Potential energy, Line integral of electric field, Conservative nature of electrostatic field, Relation between field and potential, Electric flux, Coulomb's law, Gauss's law, Applications of Gauss's law: Determination of field and potentials due to (i) An infinite line of charge, (ii) Two parallel charged sheets, (iii) A charged spherical shell, (iv) A uniformly charged solid sphere

Unit-2: Dielectrics & Conductors

Electrostatic boundary conditions, Solution of Laplace's equation for simple cases. Conductors, capacitors, dielectrics, dielectric polarization, volume and surface charges, electrostatic energy.

Unit-3: Magnetic Field

Magnetic field (B), Magnetic flux, Biot-Savart's law: Determination of magnetic field due to (i) A straight current carrying conductor and (ii) Current loop, Ampere's circuital law: Determination of magnetic field due to (i) A solenoid and (ii) A toroid

Unit-4: Electromagnetic Induction

Faraday's law, Lenz's law, Self and mutual induction, Energy stored in magnetic field. Self and mutual

inductance. Alternating currents. Simple DC and AC circuits with R, L and C components.

Unit-5: Electromagnetic Theory

Maxwell's equations, Plane electromagnetic waves, Displacement current and equation of continuity, Electromagnetic wave propagation: plane wave in free space, plane waves in good conductors, Poynting theorem and Poynting vector.

Reflection and refraction at a dielectric interface, transmission and reflection coefficients (normal incidence only). Lorentz Force and motion of charged particles in electric and magnetic fields.

Text and Reference Books

Text Book:

1. Edward M. Purcell, Electricity and Magnetism, (McGraw-Hill Education, 1986)
2. David J. Griffiths, Introduction to Electrodynamics, 3rd Edn, (Benjamin Cummings, 1998).

Reference Books:

1. Arthur F. Kip, Fundamentals of Electricity and Magnetism , (McGraw-Hill, 1968)
2. J. H. Fewkes & John Yarwood, Electricity and Magnetism, Vol.-I (Oxford Univ. Press, 1991).
3. D. C. Tayal, Electricity and Magnetism. (Himalaya Publishing House, 1988).

Course Outcomes:

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

CO1	To define or describe Electromagnetism with electric and magnetic field
CO2	To understand the different laws in electric(gauss's law and applications) and magnetic field(Biot and Savart's laws, Ampere's laws)
CO3	To apply the different laws of electric and magnetic field for Maxwell equations and also applying the different method for the solution of numerical problems
CO4	To analyse the behaviour of Maxwell equations for electromagnetic waves and also estimate electromagnetic waves in different media.
CO5	To Evaluate numerical problems and theorems of the electromagnetism.
CO6	To Classify the possible differences for E.M. waves on the basis of the different media.

CPR351 : PHYSICS (EM) LAB-III

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

Note: Student has to perform any eight experiments, selecting a minimum of three experiments from each of the following group;

1. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment.
2. Charging and discharging in RC and LCR Circuits.
3. A.C. Bridges.
4. Half wave and full wave rectifiers.
5. To determine the frequency of AC mains by Sonometer.
6. To study the response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance and (c) Quality factor Q, and (d) Band width.
7. To study the response curve of a Parallel LCR circuit and determine its (a) Anti - resonant frequency and (b) Quality factor Q.
8. To determine the specific resistance of a given wire using Carey Foster's bridge.
9. To determine a Low Resistance by a Potentiometer.
10. To calibrate the given ammeter and voltmeter by potentiometer.
11. To draw hysteresis curve of a given sample of ferromagnetic material and from - this to determine magnetic susceptibility and permeability of the given specimen.
12. To determine the ballistic constant of a ballistic galvanometer.
13. To study the variation of magnetic field along the axis of current carrying - circular coil and then to estimate the radius of the coil.
14. To determine Self Inductance of a Coil by Anderson's Bridge using AC

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, KitabMahal, 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.

CSR301 : 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 Kinetic theory of gases, Carnot cycle and efficiency of reversible engine, electromotive force and chemical equilibrium.

Course Objectives:

1. To know about laws of thermodynamics and Carnot cycle.
2. To understand the concept of entropy and Gibbs free energy
3. To learn the phase rules and draw the phase diagrams of one component systems two component systems.
4. To know the Third Law of thermodynamics and Nernst hear theorem.
5. To understand the Heat capacities.

Detailed Syllabus

Unit-1: Theory of Gases

Equation of state for ideal and non-ideal (van der Waals) gases; Kinetic theory of gases; Maxwell-Boltzmann distribution law; equipartition of energy.

Unit-2: Thermodynamics:

1st Law : Introduction to thermodynamics, definition of heat, energy and work, 1st Law of thermodynamics and its implications, Enthalpy, Heat capacities, Joule Thompson effect.

2nd Law : Second Law of thermodynamics, Carnot cycle and efficiency of reversible engine, Clausius inequality, conditions of spontaneity, Helmholtz and Gibbs free energy, Third Law of thermodynamics and Nernst hear theorem.

Unit-3: Chemical Equilibrium

The Gibbs energy minimum, the description of equilibrium, how equilibria respond to pressure and temperature.

Unit-4: Electrochemical Equilibrium

Half-reactions and electrode, varieties of cells, the electromotive force, standard potentials.

Unit-5: Phase Equilibria:

Phase, component, degree of freedom, Phase rule, thermodynamic derivation of phase rule, phase diagrams of one component systems (water), two component systems (phenol-water, lead-silver, tin-magnesium). The distribution law, applications to cases of dissociation and association of solutes in one of the phases.

Unit-6: Quantum Mechanics

Postulates of Quantum mechanics, model systems such as Particle in 1D box, Simple Harmonic Oscillators, Hydrogen atom (Hamiltonian and solutions).

Text and Reference Books

Reference Books:

1. *"Physical Chemistry",* P. C. Rakshit, 5th Edition (1985), 4th Reprint (1997), SaratBookHouse, Calcutta.
2. *"Principles of Physical Chemistry",* B. R. Puri, L. R. Sharma, and M. S. Pathania, 37thEdition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.

Course Outcomes:

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

CO1	Describe the Maxwell-Boltzmann distribution law
CO2	Understand the Nernst hear theorem.
CO3	Explain the equilibria responds to pressure and temperature.
CO4	Develop the half-reactions and electrode.
CO5	Calculate the phase diagrams of one component systems (water), two component systems.
CO6	Illustrate the quantum mechanics, model systems.

CSR351: PHYSICAL CHEMISTRY LAB-III

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: Skills to perform physical chemistry experiments.

Course Objectives:

1. To study the equilibrium of a reaction using distribution method.
2. To carry out potentiometric titrations between acids and bases.
3. Potentiometric titration of Mohr's salt with potassium dichromate.
4. Determination of critical solution temperature.

Detailed Syllabus

List of Experiments

1. Study the equilibrium of at least one of the following reactions by the distribution method:
$I_2(aq) + I^- \rightarrow I_3^-(aq)$
$Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n^{2+}$
2. Perform the following potentiometric titrations (at least two):
Strong acid with strong base
weak acid with strong base and
dibasic acid with strong base
3. (III) Potentiometric titration of Mohr's salt with potassium dichromate.
4. (IV) Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.

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

Text and Reference Books

Reference Books:

1. "Vogel's Quantitative Analysis" by J. Mendham, Pearson Education; 6 edition (2009).

Course Outcomes:

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

CO1	Perform common laboratory techniques.
CO2	Handle laboratory glassware, equipment, and chemical reagents.
CO3	Measure equilibrium concentrations and equilibrium constants.
CO4	Employ the potentiometer to perform titration experiments.
CO5	Collect, record, and analyze data.
CO6	Develop of skill to design experiments for a specific goal.

CMR 301: VECTOR CALCULUS AND ELEMENTARY ANALYSIS

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: introduction of vector , vector integration and differentiation , sequence and series

COURSE OBJECTIVE:

1. To understand and appropriately use the technical vocabulary of the topics covered such as vector, vector-valued function, tangent vector, space curve, tangential components, normal components.
2. To use vectors to solve problems involving force, velocity, work, and real-life problems
3. To analyze vectors in space.
4. To understand the relationship between the line , surface and volume integral.

Unit-1

Introduction to Vector Calculus, scalar triple product, vector triple product.

Vector differentiation: Velocity, Acceleration of a particle moving on a space curve. Scalar point function, vector point function, Gradient, velocity potential, divergence and curl of a vector and their physical interpretations.

Unit-2

Vector Integration: Line, surface and volume integrals, Statement and problems of Green's, Stoke's and Gauss divergence theorems (without proof).

Unit-3

Sequences: Sequences, bounded sequence, limit of a sequence, convergent sequences, limit theorems, monotone sequences, monotone convergence theorem, subsequences, convergence and divergence criteria, existence of monotonic subsequences (idea only), Bolzano-Weierstrass theorem for sequences and sets, definition of Cauchy sequence, Cauchy's convergence criterion, limit superior and limit inferior of a sequence.

Unit-4

Series: Definition of infinite series, sequence of partial sums, convergence of infinite series, Cauchy criterion, absolute and conditional convergence, convergence via boundedness of sequence of partial sums, tests of convergence: comparison test, limit comparison test, ratio test, Cauchy's nth root test (proof based on limit superior), integral test (without proof), alternating series, Leibniz test.

Text and Reference Books

1 .Shanti Narayan, A Text Book of Vector Calculus, S. Chand & Company, New Delhi.
2 .Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 1999.
3. S.C. Malik and Shanti Arora, Mathematical Analysis.
4. Shanti Narayan, Elements of Real Analysis, S. Chand & Company, New Delhi.

Course Outcomes:

After completing the course, students will be able to:

CO1	To define or describe the various types of vectors :dot, cross, triple & multiple product.
CO2	To understand the basic methods required for the study of Vectors.
CO3	To implement the different methods for vector differential & vector integral calculus.
CO4	To analyse the behaviour of sequence and series.
CO5	To Evaluate gradient, divergence, curl, greens, stoke, gauss theorems.
CO6	To classify the system of vectors in calculus.

CPR401: THERMODYNAMICS

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: Kinetic theory of gases, Black body radiation, basic statistical mechanics & elementary thermodynamics.

Course Objectives:

1. To give an overview of thermodynamic equilibrium and quasi static process. Various thermodynamical laws.
2. To give complete knowledge of physical significance and connection of various laws to physical quantities involved**.**
3. To describe the applications of thermo dynamical parameters and the laws.
4. To explain the concept of entropy and its change in various processes.
5. To organize the understanding of thermodynamical potentials and Maxwell's relations.
6. To create solutions for given thermodynamical situations using Maxwell's relations and derive conclusions about evolution of system over time.

Detailed Syllabus

Unit-1: Laws of Thermodynamics

Thermo-dynamical equilibrium and quasi-static process, Zeroth law of thermodynamics and concept of temperature, Work and heat energy, First law of thermodynamics, Differential form of first law, Internal energy, First law and explanation of various thermo-dynamical processes, Applications of first law: general relation between C_P and C_V, Work done during isothermal and adiabatic processes, Reversible and irreversible changes, Heat engines, Carnot cycle, Carnot engine and its efficiency, Absolute scale

Unit-2: Entropy

Concept of entropy, Change in entropy, Second law of thermodynamics in terms of entropy, Entropy of a perfect gas, Entropy of the universe, Entropy changes in reversible and irreversible processes, Calculations of change of entropy, Principle of increase of entropy

Unit-3:Thermodynamic Potentials & Maxwell's Relations

Thermodynamic variables, Thermodynamic potentials (U, H, F and G) and their definitions, properties and applications, Derivations of Maxwell's relations, Applications of Maxwell's relations: (i) Phase transition & Clausius-Clapeyron equation, (ii) Values of C_P - C_V, (iii) TdS equations, (iv) Joule-Thomson coefficient for ideal and Vander-Waal gases, (v) Energy equations and (vi) Change of temperature during an adiabatic process.

Unit-4: Statistical Methods

Ideas of ensembles, Phase space, Thermodynamical probabilitry, Micro & macro states, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distributions

Text and Reference Books

Text Book:

1. Mark Waldo Zemansky, Richard Dittman, Heat and Thermodynamics: An Intermediate Textbook, McGraw-Hill, 1981
2. Francis W. Sears & Gerhard L. Salinger, Thermodynamics, Kinetic Theory, and Statistical Thermodynamics, Narosa, 1986.

Reference Books:

1. Enrico Fermi, Thermodynamics, Courier Dover Publications, 1956
2. Meghnad Saha, B. N. Srivastava, A Treatise on Heat: Including Kinetic Theory of Gases, Thermodynamics and Recent Advances in Statistical Thermodynamics Indian Press, 1958
3. Garg, Bansal and Ghosh, Thermal Physics, Tata McGraw-Hill, 1993.

Course Outcomes:

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

CO1	Basic concepts of Thermodynamics and first law can be understood.
CO2	Understanding of various thermodynamical processes and to evaluate the work done.
CO3	To understand the second law of thermodynamics.
CO4	To apply the concepts and laws of thermodynamics to solve problems in thermodynamic systems such as gases, heat engines and refrigerators etc.
CO5	To apply the concept of Entropy to evaluate change of entropy in different phases of matter.
CO6	To apply the concept of thermodynamical potentials & Maxwell's equations for various therodynamical problems.
CO7	To understand the ideas of ensembles, Phase space, Thermodynamical probability, Micro & macro states and different particle distributions viz. Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distributions

CPR451: PHYSICS (THERMO.) LAB-IV

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

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 determine the value of Boltzmann Constant by studying Forward Characteristics of a Diode.
2. To determine the value of Planck's constant by using a Photoelectric Cell.
3. To determine High Resistance by Leakage of a Capacitor.
4. To verify Stefan's law using thermal or electrical method.
5. To determine the capacitance of a capacitor with Wein's series resistance bridge for capacity measurement.
6. To determine the self-inductance of a given coil by Maxwell's inductance Bridge.
7. To draw the characteristic curves of a photo cell and to find the maximum velocity of the emitted electrons.
8. To determine the value of Plank's constant and work function of the material of the cathode of a photo electric cell.
9. To determine high resistance by leakage method.

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 make correct measurements using laboratory 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
CO4	To analyze the observations by calculating the related physical quantities.
CO5	To evaluate the percentage and maximum probable error.
CO6	To minimize the sources of error and designing additional related experiments

CSR401: 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 molecular orbital theory, relative strength of acids and Crystals and crystal systems.

Course Objectives:

1. To know about Valence Bond theory.
2. To understand the Hard and Soft Acids Bases (HSAB).
3. To learn the reduction potentials.
4. To learn the NaCl and KCl structures.
5. To know the bonding properties of trivalent nitrogen.
6. To understand the heat capacity of solids.

Detailed Syllabus

Unit-1: Molecular Structure and Bonding

Lewis structure, octet rule, VSPER model, Valence Bond theory, hydrogen molecule, homonuclear diatomic molecules, polyatomic molecules,
molecular orbital theory, homonuclear diatomic molecules and heteronuclear diatomic molecules.

Unit-2: Acids and Bases:

Bronsted- Lowry concept of acid-base reaction, solvated proton, relative strength of acids, types of acid-base reactions, leveling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids Bases (HSAB), Application of HSAB principle.

Unit-3: Redox Reactions

Oxidation and reduction reactions, reduction potentials, electrochemical series, Nernst equation, variable valency of metals and disproportionation reactions.

Unit-4: Solid State: Crystals and crystal systems; X-rays; NaCl and KCl structures; close packing; atomic and ionic radii; radius ratio rules; lattice energy; Born-Haber cycle; isomorphism; heat capacity of solids.

Unit-5: Chemistry of s and p-block elements

Inert pair effect, structure and bonding of boron nitrides and comparison with graphite structure, shape and bonding of diborane, bonding properties of trivalent nitrogen and phosphorous, shape and bonding of XeF_2, XeF_4 and XeF_6.

Text and Reference Books

Reference Books:

1. *"A New 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,3rdEdition (1995), John Wiley & Sons, New York.

Course Outcomes:

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

CO1	Describe the VSPER model.
CO2	Understand the molecular orbital theory, homonuclear diatomic molecules and heteronuclear diatomic molecules.
CO3	Explain the application of HSAB principle.
CO4	Develop the disproportionation reactions.
CO5	Calculate the Born-Haber cycle; isomorphism; heat capacity of solids.
CO6	Illustrate the shape and bonding of XeF_2, XeF_4 and XeF_6.

CSR451: INORGANIC CHEMISTRY LAB-IV

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: Skills to perform inorganic chemistry practical.

Course Objectives:

1. To introduce conductometry and pH meter titrations.
2. To have a hands-on using colorimeter.
3. To develop the skill of synthesis and crystallization.

Detailed Syllabus

List of Experiments

1. Inorganic Qualitative Analysis (Semi-Micro Analysis) (At least five mixtures)
2. Separation of calcium and Barium and estimation of Ca- volumetrically or Ba- gravimetrically
3. Separation of Cu and Ni from binary mixtrire solution and estimation of Cri—volumetrically and Nr—gravimetrically.
4. Estimation of oxalic acid and H2SO4 in a given mixture Solution using NaOH and KMnO4 solution.
5. Estimation of Fe by potassium dichromate using diphenyl ammine indicator.
6. Estimation of available chlorine in the given sample of bleaching powder.

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

Reference Books:

1. "Vogel's Text book on Practical Organic Chemistry" by Furniss, Pearson Education; 5 edition (2003).

Course Outcomes:

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

CO1	Design conductivity, pH meter and colorimetry and polarimeter experiments
CO2	Develop the skill to perform small scale synthesis
CO3	Learn the art of crystallization
CO4	Apply of Lambert-Beer to determine the concentration of any unknown analyte
CO5	Develop basic skills to perform derivatization of common organic functionality
CO6	Apply of chemical knowledge to perform quantitative analysis of organic samples

CMR 401: DIFFERENTIAL EQUATIONS

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: Introduction of Differential Equation and partial differential equation, Series solution

COURSE OBJECTIVES:

1. To identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order and selected higher order ordinary differential equations.
2. To evaluate first order differential equations including separable, homogeneous, exact, and linear etc.
3. To introduce partial differential equation.
4. To explain methods for solving partial differential equations.
5. To explain Legendre and Bessel functions.

Detailed Syllabus:

Unit-1

Introduction of Differential Equation, First Order & First Degree, Linear equations of Higher Orders, Homogeneous linear differential equations, Linear differential equations of the second order (including the method of variation of parameters), Simultaneous linear differential equations with constant coefficients

Unit-2

Differential equations of the first order but not of the first degree, Clairaut's equations and singular solutions.

Unit-3

Series solutions of second order differential equations, Legendre and Bessel functions (Pn and Jn only) and their properties.

Unit-4

Order, degree and formation of partial differential equations, Partial differential equations of the first order, Lagrange's equations, Charpit's general method, Linear partial differential equations with constant coefficients.

Unit-5

Applications of Partial Differential Equations Method of separation of variables for solving partial differential equations, Wave and Heat equations in one dimension. Laplace equation.

Text and Reference Books

1. B. Rai, D. P. Choudhury and H. I. Freedman, A Course in Ordinary Differential Equations, Narosa Publishing House, New Delhi, 2002.
2. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall of India, New Delhi, 1968
3. T. Amaranath, An Elementary Course in Partial Differential Equations, Narosa Publishing House, New Delhi, 2005.

COURSE OUTCOMES:

After completing the course, students will be able to:

CO1	To define or describe the ordinary differential equation, partial differential equation, special type of differential equation.
CO2	To understand the basic methods or theorems required for the study of differential equation of higher order (ODE & PDE) .
CO3	To implement the different methods or theorem to solve ordinary differential equation, partial differential equation, special type of differential equation.
CO4	To analyse the behaviour of special function in differential equation.
CO5	To Evaluate C.F+P.I, Homogenious form, simultaneous equation, normal form, variation of parameters, Bessel & legendres equation.
CO6	To classify the system of ODE & PDE.

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.

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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.