Bachelor of Science (Pass Course) PCM

Programme Code: BSM

121414

Duration- 3 Years Full Time

Programme Structure

And

Curriculum & Scheme of Examination

AMITY SCHOOL OF APPLIED SCIENCES

AMITY UNIVERSITY RAJASTHAN

B.Sc. (Pass Course)PCM

Credit Summary Sheet

Credits UG (3 years/ 6 semesters)					
Semester	**Core (CC)**	**Domain Elective (DE)**	**V/ A**	**Open Electives(OE)**	**Total**
1	18	0	6	0	24
2	18	0	6	3	27
3	18	0	6	3	27
4	18	3	6	3	30
5	18	3	6	3	30
6	21	3	2	0	26
Total	**111**	**9**	**32**	**12**	**164**

PROGRAM LEARNING OUTCOMES (PLOs)

The programme 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 organisations and also to assume administrative positions in various types of organisations. Further, acquisition of higher level degrees helps the graduates to pursue a career in academics or scientific organisations as a researcher.
After undergoing this programme, a student will be able to:

1. Identify and describe basic laws and principles governing natural and man-made physical systems,
2. Explain the underlying scientific principles that govern the systems
3. Conduct experiments as per the procedures, tabulate data and interpret results
4. Work as a member of a scientific project team and communicate across teams
5. Conduct himself/herself as a responsible citizen and professional which can further act as educationalist, academician, researcher and administrators in public, private and government organisations or business administrator with further training and education
6. Choose appropriate programmes for further learning; participate in seminars and conferencesWork alongside engineering, medical, ICT professionals and scientists to assist them in scientific problem solving
7. Pursue masters and doctoral research degrees to work in colleges, universities as professors or as scientists in research establishments

B. Sc. Pass Course(PCM)

Programme Structure

FIRST SEMESTER

Code	Course	Category	L	T	P	Credits
BSP 101	Differential Calculus	CC	3	-	-	3
BSP 102	Integral and Vector Calculus	CC	3	-	-	3
BSP 103	Mechanics	CC	2	-	-	2
BSP 104	Electromagnetism	CC	2	-	-	2
BSP 105	Physics Lab -I	CC	-	-	2	2
BSP 106	Molecular Structure and Bonding in compounds	CC	2	-	-	2
BSP 107	Some Concepts of Organic Chemistry and Hydrocarbons	CC	2	-	-	2
BSP 108	Chemistry Lab-I	CC	-	-	2	2
Value Added Courses						
BCS 101	English	VA	1	-	-	1
BSS 103	Behavioral Science – I	VA	1	-	-	1
	Foreign Language -I	VA	2	-	-	2
FLF 101	French- I					
FLG 101	German-I					
FLS 101	Spanish-I					
FLC 101	Chinese-I					
AND001	**Anandam**	NTCC			2	2
	Total					24

SECOND SEMESTER

Code	Course	Category	L	T	P	Credits
BSP 201	Abstract Algebra	CC	3	-	-	3
BSP 202	Three Dimensional Geometry	CC	3	-	-	3
BSP 203	Oscillation and Waves	CC	2	-	-	2
BSP 204	Optics	CC	2	-	-	2
BSP 205	Physics Lab -II	CC	-	-	2	2
BSP 206	Basics of Organic Chemistry	CC	2	-	-	2
BSP 207	Fundamentals of physical chemistry	CC	2	-	-	2
BSP 208	Chemistry Lab -II	CC	-	-	2	2
Open Elective 1						
		OE	3	-	-	3
Value Added Courses						
BCS 201	English	VA	1	-	-	1
BSS 203	Behavioral Science – II	VA	1	-	-	1
	Foreign Language – II	VA	2	-	-	2
FLF 201	French- II					
FLG 201	German-II					
FLS 201	Spanish-II					
FLC 201	Chinese-II					
AND002	**Anandam**	NTCC			2	2
	Total					27

THIRD SEMESTER

Code	Course	Category	L	T	P	Credits
BSP 301	Real Analysis	CC	3	-	-	3
BSP 302	Differential Equations	CC	3	-	-	3
BSP 303	Thermodynamics and statistical physics	CC	2	-	-	2
BSP 304	Electronics	CC	2	-	-	2
BSP 305	Physics Lab -III	CC	-	-	2	2
BSP 306	Inorganic Chemistry -I	CC	2	-	-	2
BSP 307	General Organic Chemistry-I	CC	2	-	-	2
BSP 308	Chemistry Lab -III	CC	-	-	2	2
Open Elective 2						
		OE	3	-	-	3
Value Added Courses						
BCS 301	Communication Skills – I	VA	1	-	-	1
BSS 303	Behavioral Science – III	VA	1	-	-	1
	Foreign Language -III	VA	2	-	-	2
FLF 301	French- III					
FLG 301	German-III					
FLS 301	Spanish-1II					
FLC 301	Chinese-III					
AND003	**Anandam**	NTCC			2	2
	Total					27

FOURTH SEMESTER

Code	Course	Category	L	T	P	Credits
BSP 401	Dynamics	CC	3	-	-	3
BSP 402	Numerical Analysis	CC	3	-	-	3
BSP 403	Mathematical Physics	CC	2	-	-	2
BSP 404	Solid state Physics and Devices	CC	2	-	-	2
BSP 405	Physics Lab -IV	CC	-	-	2	2
BSP 406	Chemistry of States of Matter	CC	2	-	-	2
BSP 407	General Organic Chemistry II	CC	2	-	-	2
BSP 408	Chemistry Lab -IV	CC	-	-	2	2
DE Electives: Student has to select 1 course from the list of following DE electives						
BSP 409	Number Theory	DE	3	-	-	3
BSP 410	Digital Electronics & Microprocessor					
BSP 411	Nuclear/Radio chemistry					
Open Elective 3						
		OE	3	-	-	3
Value Added Courses						
BCS 401	Communication Skills – II	VA	1	-	-	1
BSS 403	Behavioral Science – IV	VA	1	-	-	1
	Foreign Language – IV	VA	2	-	-	2
FLF 401	French- IV					
FLG 401	German-IV					
FLS 401	Spanish-1V					
FLC 401	Chinese-IV					
AND004	**Anandam**	NTCC			2	2
	Total					30

FIFTH SEMESTER

Code	Course	Category	L	T	P	Credits
BSP 501	Metric and Vector space	CC	3	-	-	3
BSP 502	Operations Research	CC	3	-	-	3
BSP 503	Quantum Physics	CC	2	-	-	2
BSP 504	Nuclear and Particle Physics	CC	2	-	-	2
BSP 505	Physics Lab -V	CC	-	-	2	2
BSP 506	Inorganic Chemistry-II	CC	2	-	-	2
BSP 507	Advance Physical Chemistry	CC	2	-	-	2
BSP 508	Chemistry Lab -V	CC	-	-	2	2
DE Electives: Student has to select 1 course from the list of following DE electives						
BSP 509	Partial Differential Equation	DE	3	-	-	3
BSP 510	Laser Physics					
BSP 511	Quantum Chemistry& Spectroscopy-I					
Open Elective 4						
		OE	3	-	-	3
Value Added Courses						
BCS 501	Communication Skills - III	VA	1			1
BSS 503	Behavioral Science – V	VA	1			1
	Foreign Language – V	VA	2	-	-	2
FLF 501	French- V					
FLG 501	German- V					
FLS 501	Spanish- V					
FLC 501	Chinese- V					
AND005	**Anandam**	NTCC			2	2
	Total					30

SIXTH SEMESTER

Code	Course	Category	L	T	P	Credits
BSP 601	Function of Complex Variable	CC	3	-	-	3
BSP 602	Linear Algebra	CC	3	-	-	3
BSP 603	Atomic and Molecular Spectroscopy	CC	2	-	-	2
BSP 604	NanoScience & technology	CC	2	-	-	2
BSP 605	Physics Lab -VI	CC	-	-	2	2
BSP 606	Bio-inorganic and Polymer Chemistry	CC	2	-	-	2
BSP 607	Bio-OrganicChemistry	CC	2	-	-	2
BSP 608	Chemistry Lab -VI	CC	-	-	2	2
BSP 640	Seminar (P/C/M)	CC	-	-	-	3
DE Electives: Student has to select 1 course from the list of following DE electives						
BSP 609	Atmospheric Physics	DE	3	-	-	3
BSP 610	Game Thoery					
BSP 611	Heterocyclic Chemistry&Spectroscopy-II					
AND006	**Anandam**	NTCC			2	2
	Total					26

FIRST SEMESTER

Differential Calculus

PAPER CODE: BSP 101 **CREDITS:** 3

Course Objective:

Calculus was first invented to meet the mathematical needs of scientists of the sixteenth and seventeenth centuries, needs that mainly mechanical in nature. Nowadays it is a tool used almost everywhere in the modern world to describe change and motion. Its use is widespread in science, engineering, medicine, business, industry, and many other fields. Calculus also provides important tools in understanding functions and has led to the development of new areas of mathematics including real and complex analysis, topology, and non- euclidean geometry. The objective of this course is to introduce the fundamental ideas of the differential and integral calculus of functions of one variable.

Course Contents:

Module I

Mean Value theorems (Lagrange's, Cauchy, Taylor's and Maclaurins with different remainders). Expansion of $\sin(x)$, $\cos(x)$, e^x, $\log(1+x)$, $(1+x)^m$.

Module II

Derivative of an arc, Intrinsic equation of the curve, Pedal equation (Cartesian and Polar Curves), Curvature.

Module III

Partial differentiation, Total derivative , Euler's theorem for homogeneous functions, Maxima and Minima of functions of two independent variables – necessary and sufficient conditions (without proof) , Lagrange's undetermined multipliers (without proof) and simple problems.

Module IV

Envelopes, Asymptotes (Cartesian and Polar curves).

Module V

Multiple points, Classification of double points – Node, cusp, point of inflexion. Tracing of curves: Cartesian and Polar form.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

1. Differential Calculus, Shanti Narayan, S. Chand and Co., New Delhi., 1996
2. Differential Calculus, M. Ray & G.C. Sharma, Shivlal agarwal & Co. Agra, 1998.
3. Text Book on Diff.Calculus, Gorakh Prasad, Pothishala Pvt.Ltd, Allahabad, 1992.

References:

1. Theory and problems of Advanced Cal. Schaum's outline series New York, 2011.
2. Differential Calculus, H.S. Dhami, New Age Int. Ltd., New Delhi, 2012.
3. A text Book of Differential Calculus, Akhtar & Ahsan, PHI Ltd. New Delhi, 2002.
4. A Problem book in Mathematical Analysis, G.N. Berman, Mir Publishers, Moscow, 2004

Integral and Vector Calculus

PAPER CODE: BSP 102 **CREDITS:** 3

Course Objective:
The second in the series of three calculus courses. Integral Calculus develops a set of advanced symbolic and numerical integration techniques, building on skills developed in the first course in the series, Differential Calculus. The course includes applications of integration, sequences and series, and the use of the Taylor polynomial to approximate functions. Students are introduced to parametric and polar equations.

Course Contents:

Module I

Reduction Formulae: $\sin^n x$, $\cos^n x$, $\tan^m x$ and $\sin^m x \cos^n x$, where m, n are positive integers. Definition and properties of Gamma and Beta functions, Relation between Gamma and Beta functions, Duplication formula and simple problems related to these functions.

Module II

Rectification: length of Cartesian and polar curves. Quadrature: Area of Cartesian and polar curves, Volumes and Surfaces of solids of revolution.

Module III

Double integrals, Change of order of integration, Triple integrals, Drichlet's Integral

Module IV

Scalar and vector point functions, Differentiation and Integration of vector point function, Gradient, directional derivatives, Divergence and Curl of a vector point function.

Module V

Identities involving differential vector operators, Gauss divergence, Stokes and Greens theorems (without proofs) and their applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

1.A text book on Integral Calculus, Gorakh Prasad, Pothishala Pvt .Ltd , Allahabad, 1992.
2. Integral Calculus, Sharma & Jain Galgotia Publication, Dariyaganj, New Delhi, 2001.
3. Integral Calculus, Shanti Narayan, S.Chand and Co., New Delhi, 1996.
4. A text book of Vector Calculus, Shanti Narayan, S.Chand and Co.New Delhi, 1996.
5. Vector algebra &Calculus, Ray and Sharma, Students and Friends Co. Agra, 1998

References:

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley and sons, 2005.
2. Vector Analysis, Muray R. Spiegel , Schaum Publishing Company , New York, 2007.
3. Introduction to Vector Analysis, Saran and Nigam , Pothisala Pvt. Ltd, Allahabad, 2001.

Mechanics

PAPER CODE: BSP 103 **CREDITS:** 2

OBJECTIVE:

To acquaint the students with the fundamental laws and principles involved in motion so that they develop abilities and skill that are relevant to the study and practice of Physics.

MODULE I:

Physical Laws and Frames of Reference:

Inertial and non inertial frames, examples, Transformation of displacement, velocity and acceleration between different frames of reference involving translation in uniform motion, Galilean transformation and invariance of Newton's laws, Transformation equations of displacement velocity and acceleration for rotating frames, Fictitious forces (Coriolis force and centrifugal force).

MODULE II:

Centre of mass:

Centre of mass of a two particle system, motion of centre of mass and reduced mass conservation of linear momentum, elastic and inelastic collision of two particles in laboratory and center of mass frames, motion of a system with varying mass, Angular momentum conservation with examples.

MODULE III:

Motion under central forces:

Motion under central forces, gravitational interaction, general solution under gravitational interaction, discussion of trajectories, cases of elliptical and circular orbits, Keplers laws.

MODULE IV:

Special theory of relativity:

Postulates of special theory of relativity, Lorentz transformations, length contraction, Time dilation, transformation and addition of velocities, Relativistic Doppler's effect.

Text & References:

1. "Elements of Mechanics", Gupta, Prakash and Agrawal, PragatiPrakashan, Meerut.
2. "Elements of Mechanics", J.C.Upadhyaya ,Himalaya Publishing House,2006.

3. References

1. "Fundamental University Physics", Vol. I and II, Addison Wesley, Reading Mars, LISA.
2. "Berkley Physics Course", Vol. I, Mc. Graw Hill, New York.
3. "The Feynmann Lectures in Physics", Vol. 1, R. P. Feynman, R.B. Leighton and M. Sands , B.I. Publications, Bombay, Delhi, Calcutta, Madras.
4. "Physics",Part 1, David Halliday and Resnick , John Wiley and Sons, Inc. Newyork.

Electromagnetism

PAPER CODE: BSP 104 **CREDITS:** 2

OBJECTIVE:

This course will acquaint the students with the scalar and vector fields, gradient, divergence, curl and their physical significance. Students will also learn about the fields produced by moving charges and magnetic fields in matter, electromagnetic induction, Maxwell's equations and electromagnetic waves.

MODULE I:

Scalar and vector fields:

Partial derivatives, Gradient of a scalar function. Line integral of a vector field, Divergence and Curl of a vector field, Physical significance of divergence & curl and their expressions in Cartesian coordinates, Gauss divergence theorem, Stokes curl theorem, Laplacian operator.

MODULE II:

Dynamics of a charged particle

Magnetic forces, Invariance of charge, Electric field measured in different frames of reference, Field of a point charge moving with constant velocity, Interaction between a moving charge and other moving charges.

MODULE III:

Magnetostatics:

Ampere's law in differential form, Magnetic Vector Potential, Poisson's equation for vector potential, magnetic field due to a current carrying wire and deduction of Biot-Savart's law.

Electric current due to an orbiting electron, Bohr Magneton, Orbital gyro magnetic ratio, Electron spin and spin magnetic moment, magnetic susceptibility, magnetic field caused by magnetized matter, Magnetization current.

MODULE IV:

Electrostatics:

Moments of a charge distribution, Atomic and molecular dipoles, Atomic Polarizability, Permanent dipole moment, Dielectrics, capacitor filled with dielectric, the potential and field due to a polarized sphere, dielectric sphere in a uniform electric field, The electric field of charge in dielectric medium and Gauss law, Relation between electric susceptibility and atomic polarizability, Polarization due to changing electric field.

MODULE V:

Maxwell's equations and electromagnetic waves:

Faraday's laws of electromagnetic induction, its integral and differential form, Maxwell's displacement current, Maxwell's equations in differential and integral form,Poynting's theorem,

Text & References:

1. "Electricity and Magnetism with Electronics", K.K.Tewari, S.Chand& Co. Ltd. (2001)
2. "Electricity and Magnetism", D.Chattopadhyay, P.C.Rakshit, New Central Book Agency (P) Ltd.

REFERENCES:

1. "Elements of Electromagnetics", Mathew, N.D. Sadika, New Delhi, Oxford University Press.
2. "Electricity and Magnetism", W.J.Duffin ,McGraw Hill Book Co., Fourth edition.
3. "Electromagnetics", B.B.Laud ,New Age International Publishers, Second edition.
4. "Electromagnetic theory and electrodynamics", SatyaPrakash, KedarNath Ram Nath& Co. Publishers, Meerut, Ninth edition.
5. "Physics Part 2",D.Halliday and R.Resnick, John Wiley and Sons, Inc. Newyork.
6. "Principles of Electricity and Magnetism",S.Palit, Narosa Publishing House.

PHYSICS LAB-I

PAPER CODE: BSP 105 **CREDITS:** 2

Course Contents:

1. To determine the Moment of Inertia of a Flywheel.
2. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
3. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
4. Determination of moment of inertia of metallic cylinder / rectangular bar about an axis passing through its C.G.and to determine the rigidity modulus of the material of the suspension wire.
5. To determine the wavelength of a monochromatic light by Newton's ring method.
6. Measurement of the slit width and the separation between the slits of a double slit by observing the diffraction and interference fringes.
7. To calibrate a polarimeter and hence to determine the concentration of sugar solution.
8. To determine the refractive index of material of Prism using Spectrometer.
9. To determine the wavelength of spectral lines of Mercury lamp using diffraction grating.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Molecular, Structure & Bonding in compounds

Paper Code – BSP106 **Credits 2**

Module I

Ionic Solids: Ionic structures, radius ratio effect and coordination number, limitations of radius ratio rule, lattice defects, semiconductors, lattice energy and born haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions, fajans rule.

Metallic Bond: Free electron, valence bond and band theories

Weak Interactions: Hydrogen bonding, vanderwaals forces

Module II

Covalent Bond: Valence bond theory and its limitations, directional and shapes of simple inorganic molecules and ions, valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, ClF_3, ICl_2, H_2O

Molecular Orbital Theory: Homonuclear and heteronuclear (CO and NO) diatomic molecules, multicentre bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

Module III

S-block elements: Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their functions in Biosystems, an introduction to alkyls and aryls

Periodicity of p-block elements: Periodicity in properties of p-block elements with special reference to atomic and ionic radii, ionization energy, electron affinity, electronegativity, diagonal relationship, catenation

Books Suggested:

1. Concise Inorganic Chemistry: J. D. Lee
2. General Inorganic Chemistry: J. A. Duffy, Longman (2nd Ed.)
3. Principles of Inorganic Chemistry: B. R. Puri and L. R. Sharma
4. Basic Inorganic Chemistry: F. A. Cotton and G. Wilkinson, Wiley Eastern
5. Molecular Geometry: R. J. Gillespie, Van Nostrand Reinhold

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Some concepts of Organic Chemistry& Hydrocarbons

Paper code – BSP107 **Credits: 02**

Module I

Mechanism of organic reactions: Homolytic and heterolytic bond cleavage, types of reagents, electrophiles and nucleophiles, reactive intermidiates- carbocations, carbanions, free radicals, carbenes, arynes and nitrenes with examples, types of organic reactions, energy considerations, methods of determination of reaction mechanism (product analysis, intermidiates, isotope effects, kinetic and stereochemical studies)

Module II

Alkanes and Cycloalkanes: IUPAC nomenclature of branched and unbranched alkyl group, classification of carbon atoms in alkanes, methods of formation (with special reference of wurtz reaction, kolbe reaction, corey-house reaction and decarboxylation of carboxylix acids), physical properties and chemical reactions of alkanes, mechanism of free radical halogenation, orientation, reactivity and selectivity, cycloalkanes-nomenclature, methods of formation, chemical reaction, baeyer's strain theory and its limitations, theory of strainless rings

Module III

Alkenes, Cycloalkenes, Dienes and alkynes

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halide, regioselectivity in alcohol dehydration, The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikof's rule, hydroboration- oxidation, oxymercutation –reduction, Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO4 Polymerization of alkenes, Substitution at the allylic and vinylic-positions of alkenes. Industrial applications of ethylene and propene, Methods of formation, conformation and chemical reactions of cycloalkenes, Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes, Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions- 1,2- and 1,4- additions, Diels-alderreaction Nomenclature, structure and bonding in alkynes, Methods of formation, Chemical reactions of alkynes, acidity of alkynes, Mechanism of electrophilic and nucleophilic addition reactions, hydroborationoxidation, metal ammonia reductions, oxidation and polymerizations.

Books Suggested:

1. A Text Book of Organic Chemistry: K. S. Tiwari, S. N. Mehrotra and N. K. Vishnoi
2. Modern Principles of Organic Chemistry: M. K. Jain and S. C. Sharma
3. A Text Book of Organic Chemistry: (Vol. I & II) O. P. Agarwal
4. A Text Book of Organic Chemistry: B. S. Bahl and ArunBahl
5. A Text Book of Organic Chemistry: P. L. Soni
6. Organic Chemistry: (Vol. I, II & III) S. M. Mukherji, S. P. Singh and R. P. Kapoor, Wiley Eastern Ltd. (New Age International)
7. Organic Chemistry: Morrison & Boyd, Prentice Hall

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

CHEMISTRY LAB -I

BSM108 **Credit 2**

NOTE: Students are expected to perform any eight experiments from the given list. The duration of the Practical Examination shall be 5 hours. The distribution of marks in the practical examination will be as follows:

1. Three experiments: 20 Mark each.
2. Distribution of marks will be as follows:

Figure /Formula/Theory	:	5
Observations/Calculations	:	8
Result /Result Analysis	:	5
Precautions	:	2
Viva -Voce	:	10

Experiments:

1. Semimicro / Macro Analysis -Cation analysis, separation and identification of ions from groups I,II,III,IV, V and VI, Anion analysis.(4 radicals)
2. Crystallization

   Concept of induction of crystallization: Phthalic acid from hot water (using fluted filter paper and stemless funnel) Acetanilide from boiling water, Napthelene from Ethanol Benzoic acid from water.

3. Decolorisation and crystallization using charcoal

   Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration, Crystallization and decolorisation of impure naphthalene (100 g of naphthalene mixed with 0.3g. of Congo Red using l.0 g decolorising carbon) from ethanol, Sublimation (Simple and vacuum) Camphor, Naphthalene, phthalic acid and Succinic acid

4. Qualitative Analysis

   Detection of extra elements (N, S and halogens) and functionl groups (phenolic, caboxylic, carbonyl, ester, carohydrates, amine, amide, nitro and anilide) in simple organic compunds
5. Colloids
   To prepare arsenious sulphide sol and compare the precipitating power of mono-, bi- and trivalalent anions.
6. **Viscosity, Surface Tension**
   To determine the percentage composition of a given, mixture (non interactingsystems) by vicosity method.
   To determine the viscosity of Amyl alcohol in water at different concentrations and calculate the viscosity of these solutions.
   To determine the percentage composition of a given binary mixture by surface - tension method (acetone & ethyl-ketone).

Books suggested:

1. Practical Chemistry: GiriBajpai and Pandey, S. Chand & Co. Ltd., New Delhi

SECOND SEMESTER

Abstract Algebra

PAPER CODE: BSP 201 **CREDITS:** 3

Course Objective:
In this course, students will be expected to learn, understand, and communicate definitions, examples, fundamental theorems and applications relevant to the study of rings and fields, and analyze, develop, and communicate rigorous mathematical proofs of statements concerning rings and fields.

Course Contents:

Module I

Definition of a group with examples and simple properties. Order of elements in a Group and related theorem.

Module II

Subgroups ,Cyclic groups, Permutation groups, Alternating groups.

Module III

Cosets, Lagrange's theorem Normal subgroups , Quotient group.

Module IV

Homomorphism and Isomorphism, the Fundamental theorem of homomorphism. Rings:- Definition, Examples and Elementary properties.

Module V

Integral domain, Fields, Subfields and their simple properties, Subrings. Ideal of a ring, Characteristic of a ring.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

1. K. C. Sarangi , Elements of Abstract Algebra, RBD, Jaipur, 2009.
2. P. B. Bhattacharya , S.K.Jain and S.R.Nagpaul,Basic Abstract Algebra , Cambridge University Press, 2001.
3. K.C. Sharma and D.C. Gokhroo, Abstract Algebra, publisher JPH
4. G. C. Sharma, Modern Algebra, Shivlal Agarwal & Co. Agra, 1998.

References:

1. Abstract Algebra, Deepak Chatterjee, PHI. Ltd. New Delhi,2001
2. Topics in Algebra, I.N. Herstein , Wiley Eastern Ltd., New Delhi,2008
3. Abstract Algebra, Theory and Applications by Thomas W. Judson & Robert A. Beezer,2015

Three Dimensional Geometry

PAPER CODE: BSP 202 **CREDITS:** 3

Course Objective:

Geometry is a part of mathematics concerned with questions of size, shape, and relative position of figures. The purpose of this course is to construct, develop logical arguments, and apply established theorems to two and three-dimensional figures. Coordinate geometry is an ongoing theme in the course to maintain student's prior algebraic skills needed for future courses. In this course, students are expected to demonstrate their ability to solve multi-dimensional figure problems by use of geometric tools, proofs, and formulas. Additionally, they are expected to justify steps in a geometric procedure and verify algebraically when possible.

Course Contents:

Module I

Equation of plane. Pair of planes. Equations of a line. Line and plane. Shortest distance.

Module II

Equation of a sphere, Centre and radius of a sphere, Great circle, Equation of circle, Diameter form of the equation of a sphere, Tangent line and tangent plane of a sphere, Condition of tangency for a line and equation of tangent plane, Angle of intersection of two spheres, Condition of orthogonality of two spheres.

Module III

Cone, Quadratic Cone, Equation of a cone, Enveloping cone, Condition for general equation of second degree to represent a cone, Intersection with a line and a plane, Angle between the intersecting lines of cone, Tangent plane, Reciprocal Cone, Right Circular Cone.

Module IV

Equation cylinder, Enveloping and right circular cylinders. Equations of central conicoids, Tangent plane, Normal, Plane of contact and polar plane, Enveloping cone and enveloping Cylinder, Conjugate diameters and diameters planes. Equations of paraboloids and its simple properties.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

1. Analytical Geometry of three dimensions, N. Saran and R.S. Gupta , Pothisala Pvt.Ltd , Allahabad, 1992.
2. Text book on Coordinate Geometry, Gorakh Prasad and H.C. Gupta , Pothisala Pvt. Ltd., Allahabad, 1992.
3. A text book of Analytical Geometry of Two dimensions, P.K. Jain and Khalil Ahmad, Wiley Eastern Ltd, 1997..
4. Co-ordinate Geometry, Sharma & Jain, Galgotia Publication, Dariyaganj, New Delhi, 1996.
5. A text book of Analytical Geometry of Three Dimensions, P.K. Jain and Khalil Ahmad, Wiley Eastern Ltd, 2000.

References:

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley and sons, 2005.
2. Vector Analysis, Muray R. Spiegel , Schaum Publishing Company , New York, 2007.
3. Introduction to Vector Analysis, Saran and Nigam , Pothisala Pvt. Ltd, Allahabad, 2001.

Oscillation and Waves

PAPER CODE: BSP 203 **CREDITS:** 2

OBJECTIVE:

To familiarize the students with motion of different types of oscillators and also with wave motion in different medium. This will enable the students to develop abilities and skill to solve problems related to waves and oscillations.

MODULE I:

Simple harmonic and damped oscillator

Simple harmonic motion, Differential equation of simple harmonic motion, examples:-mass on a spring, Torsional oscillator. LC Circuit, Potential energy curve and small oscillations in one dimensional potential well, Energy of oscillations, mass and two spring system.

Damped harmonic oscillator, Mathematical formulation of damped harmonic oscillator, Energy of damped oscillator, Power dissipation, Relaxation time, Quality factor of damped harmonic oscillator.

MODULE II:

Driven harmonic oscillator

Driven harmonic oscillator, Mathematical formulation of driven harmonic oscillator, Frequency response on amplitude and phase, Quality factor of driven oscillator, Resonance, Sharpness of resonance, Power absorption by forced oscillator, Series and parallel LCR circuit.

MODULE III:

Coupled oscillators

Equation of motion of two coupled simple harmonic oscillators, Normal modes, motion in mixed modes,dynamics of a linear chain of coupled oscillators with nearest neighbor interaction, Energy transfer between modes, Electrically coupled circuits (capacitive and inductive), Reflected impedance, effect of coupling and resistive load.

MODULE IV:

Wave motion

Wave equation, Transverse waves in a string, Elastic waves in a solid rod, Pressure waves in a gas column, Plane electromagnetic waves, Energy and Momentum of EM waves, Radiation pressure, Radiation resistance of free space.

TEXT & REFERANCES:

1. "The Physics of Waves and Oscillations", N.K.Bajaj, Tata McGraw Hill Publishing Co., 2003.
2. "Oscillations,waves and electromagnetism", SatyaPrakash, PragatiPrakashan, Meerut.

REFERENCES:

1. "Fundamental University Physics", Vol I and II , M.Alonso&J.Finn, AddissonWiesley.
2. "Vibrations and Waves", A.P. French, CBS Publication and Distributors.
   - "Berkeley Physics Course", Vol. I , New York, McGraw Hill.
4. "Vibrations and waves", I.G. Main ,Cambridge University Press. "

Optics

PAPER CODE- BSP204 **Credit – 02**

Ray optics, Plane and spherical Mirrors, Lens, image formation, Lens formula.
Microscope and Telescope

OBJECTIVE:

This course familiarizes the students with the phenomenon of interference, diffraction, polarization to enable them to acquire sufficient understanding and knowledge to recognize the usefulness of these phenomena in everyday life and also stimulate their interest in Physics.

MODULE I:

Geometric Optics and its applications: Ray optics, Plane and spherical Mirrors, Lens, image formation, Lens formula Microscope and Telescope.

MODULE II:

Ray Optics

Interference

Young's double slit experiment, types of interference: division of amplitude, division of wave front, Coherence: temporal and spatial coherence, Interference in thin films, colour in thin films, Newton's rings, Determination of wavelength and refractive index of liquid by Newton's rings, Michelson interferometer, Applications of Michelson interferometer: determination of wavelength, difference of wavelength and thickness of thin films.

MODULE III:

Diffraction

Fresnel diffraction: Fresnel's assumptions, Half period zones, Distinction between interference and diffraction, Difference between Fresnel and Fraunhoffer diffraction, diffraction at a circular aperture, straight edge and thin slit, zone plate, difference between zone plate and a convex lens.
Franunhoffer diffraction: Diffraction at single slit, Diffraction at double slit, Diffraction at N slits (simple derivation), plane diffraction grating, dispersion by a grating, resolving power of a grating.

MODULE IV:

Polarization

Plane electromagnetic waves. E and B of linearly, circularly, elliptically polarized electromagnetic waves. Polarization by reflection, Huygens theory of double refraction, production and Analysis of plane, circularly and elliptically polarized light, Quarter and half wave plate. Optical activity, specific rotation, Biquartz and half shade polarimeters.

Text & References:

1. "A textbook of Optics", Brijlal and Subramaniam, S.Chand & Company Ltd.,23rd edition.
2. "Essentials of Lasers and non-linear Optics",G.D.Baruah, Pragati Prakashan, Meerut.

- A Textbook of Optics: N. Subrahmanyam and B. Lal (S. Chand & Co.,N. Delhi, 1987).
- Physical Optics: B. K. Mathur and T. P. Pandya.
- Geometrical and Physical Optics: Longhurst.
- Introduction to Modern Optics: G. R. Fowels.
- Optics: P. K. Srivastav.

PHYSICS LAB-II

Paper Code – BSP205 **Credit: 02**

Course Contents:

1. To determine the Coefficient of Thermal Conductivity of Copper by Searle's apparatus.
2. To determine the Coefficient of Thermal Conductivity of Copper by Angstrom's Method.
3. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
4. To investigate the Motion of Coupled Oscillators.
5. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment.
6. To verify λ^2 – T Law by Melde's Experiment.
7. To study the variation of Thermo-Emf of a Thermocouple with Difference of temperature of its Two Junctions.
8. To determine the value of acceleration (g) due to gravity.
9. To determine the frequency of tuning fork using sonometer.

Any other experiment carried out in the class.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Basics of Organic Chemistry

Paper Code : BSP206 **Credits: 02**

Module I

Arenes & Aromaticity

Nomenclature of benzene derivatives, the aryl group, Aromatic nucleus and side chain structure of benzene: molecular formula and Kekule structure Stability. Aromaticity: the Huckle's rule, aromatic ions, Aromatic electrophilic substitution-general pattern of the mechanism, role of σ and π complexes, Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel Crafts reaction, energy profile diagrams. Activating & deactivating substituentss, orientation and otho/para ratio, Side chain reactions of benzene derivatives. Birch reduction

Module II

Stereochemistry of organic compounds: concept of isomerism, types of isomerism, differences between configuration and conformation, flying wedge and fisher projection formulae

Optical isomerism: elements of symmetry, molecular chirality, enantiomers, stereogeniccentre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, distereomers threo and erythro isomers, meso compounds, resolution of enantiomers, inversion, retention and racemization with examples, relative and absolute configuration, sequence rule D/L, R/S systems of nomenclature

Geomatric isomerism: Determination of configuration of geometric isomers-cis/trans and E/Z systems of nomenclture, geometric isomerism in oximes and alicyclic compounds

Module III

Nomenclature and classes of alkyl halides, mothods of formation, chemical reactions, Mechanism of nucleophilic substitution reactions of alky halides, SN_2 and SN_1reactions with energy profile diagrams,Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions, The addition, elimination and the elimination-addition mechanism of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl vs allyl, vinyl and aryl halides, Synthesis and use of D.D.T. and B.H.C

Books Suggested:

1. A Text Book of Organic Chemistry: K. S. Tiwari, S. N. Mehrotra and N. K. Vishnoi
2. Modern Principles of Organic Chemistry: M. K. Jain and S. C. Sharma
3. A Text Book of Organic Chemistry: (Vol. I & II) O. P. Agarwal
4. A Text Book of Organic Chemistry: B. S. Bahl and ArunBahl
5. A Text Book of Organic Chemistry: P. L. Soni
6. Organic Chemistry: (Vol. I, II & III) S. M. Mukherji, S. P. Singh and R. P. Kapoor, Wiley Eastern Ltd. (New Age International)
7. Organic Chemistry: Morrison & Boyd, Prentice Hall

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Fundamentals of physical chemistry

Paper Code : BSP207 **Credits: 02**

Module I

Electro Chemistry - I

Electrical Transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution, migration of ions and kohlrausch law, Arrhenius theory of electrolyte dissociation and Its limitations, weak and strong electrolytes, Ostwald dilution law, its uses and limitations. debye-Huckle- onsager's equation for strong electrolytes (Elementary Treatment Only). Transport number, definition and determination by Hittorf's method and moving boundary method.

Applications of conductivity measurements: Determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Module II

Chemical Kinetics and Catalysis

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction concentration, temperature,pressure, solvent,light,catalyst, Concentration dependence of rates, mathematical characteristics of simple chemical reactions zero-order, first order, second order, pseudo order, half-life and mean life period. Determination of the order of reaction: differential method; method of integration, method of half life period and isolation methodRadioactivedccay as a first order phenomenon. Experimental methods of chemical kinetics: conductometric, Potentiometric,opticalmethods, polarimetry and spectrophotometry, Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius concept of activation energy, Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis), Expression for the rate constant based on equilibrium constant and thermodynamic aspects, Catalysis, characteristics of catalysed reactions, classification of catalysis, miscellaneous examples.

Module III

Thermodynamics - I

Definition of thermodynamic terms : System, Surroundings etc, Types of systems, Intensive and extensive properties. state and path functions and their differentials. Thermodynamic process, concept of heat and work, First Law of Thermodynamics: Statement, Definition of internal energy and enthalpy, heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law, Joule-Thomson coefficient, Calculation of w,q, dU&dH, for the expansion of Ideal gases under adiabatic conditions for reversible process. Second law of Thermodynamics: Need for the Law, different statements of the law, Carnot cycle and its efficiency, Carnot-Theorem, Thermodynamic scale of temperature. Concept of entropy: Entropy as a state function, entropy as a function of V&T, Entropy as a function of P&T, Entropy change in physical change, Clausius inequality and Entropy as a criteria of spontaneity and equilibiruim, Entropy change in ideal gases and mixing of gases.

Third Law of Thermodynamics : Nernst heat theorem, Statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helm -holtz function's : Gibbs function (G) and Helm holtz function (A) as: Thermodynamic quantities. A&G as criteria for Thermodynamic equilibrium and spontaneity, their advantage over entropy change, variation of G and A with P.V. and T.

Books Suggested:

1. Principles of Physical Chemistry: B. R. Puri and L. R. Sharma
2. A Text Book of Physical Chemistry: A. S. Negi and S. C. Anand
3. Physical Chemistry, Pt. I & II: C. M. Gupta, J. K. Saxena and M. C. Purohit
4. Computers and Applications to Chemistry: Ramesh Kumari, Narosa Publishing House P. Ltd.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

CHEMISTRY LAB-II

BSP 208 **Credit 2**

NOTE: Students are expected to perform any eight experiments from the given list. The duration of the Practical Examination shall be 4 hours. The distribution of marks in the practical examination will be as follows:

1. Three experiments: 20 Mark each.
2. Distribution of marks will be as follows:

Figure /Formula/Theory	:	5
Observations/Calculations	:	8
Result /Result Analysis	:	5
Precautions	:	2
3. Viva -Voce	:	10

List of Experiments:

1. Semi-micro / Macro Analysis -Cation analysis, separation and identification of ions from groups I,II,III,IV,V and VI, Anion analysis.(6 radicals)
2. Determination of melting point: Naphthalene, Benzoic acid, Urea, Succinic Acid, Cinnamic acid, m-Dinitrobenzene, p-Dichlorobenzene,Aspirin
3. Detemination of boiling Points: Ethanol, Cyclohexane, Toluene, Benzene,
4. Mixed Melting point determination: Urea -Cinnamic acid mixture of various compositions (1:4,1;1,4;1)
5. Distillation: Simple distillation of ethanol -water, using water condenser
6. Chemical Kinetics

- To determine the specific reaction rate of the hydrolysis of methyl ac etate/ ethyl acetate catalyzed by hydrogen ions at room temperature.
- To study the effect of acid strength on the hydrolysis of an ester.
- To comopare the strengths of HCl and H2SO4 by studying the Kinetics of hydrolysis of ethyl-acetate.
- To study kinetically the reaction of decomposition of iodide by H_2O_2

7. Distribution Law

- To study the distribution of iodine between water and CCl_4
- To study the distribution of benzoic acid between benzene and water

Books suggested:

1. Practical Chemistry: GiriBajpai and Pandey, S. Chand & Co. Ltd., New Delhi

THIRD SEMESTER

Real Analysis

PAPER CODE: BSP 301 **CREDITS:** 3

Course Objective:
The aim of the module is to introduce the students to the fundamental ideas of Real Analysis: Limits of sequences, infinite series, limits of real functions, continuity, differentiability and the Riemann integral. The module should encourage students to think clearly and critically and to begin to be able to prove simple statements on their own.

Course Contents:

Module I
Order completeness of Real numbers, open and closed sets, limit point of sets, Bolzano Weirstrass theorem , concept of compactness, Heine Borel theorem.

Module II:
Real Sequences , Limit and convergence of a sequence, Monotonic sequences, Cauchy's sequences, Sub sequences and Cauchy's General principle of convergence, Infinite series and their convergences – Comparison test, Cauchy's nth root test, D'Alembert, Raabe's, Cauchy's Test, Logarithmic test.

Module III

Alternating Series – Leibnitz Test, Absolute and conditional convergence, Properties of continuous function on closed interval, derivable functions:-Derivative of composite function, The inverse function theorem and darboux theorem.

Module IV
Reimann Integration, Lower and upper Reimann integrals, Properties of Reimann integration, Mean value theorem of Integral calculus, Fundamental theorem of integral calculus.

Module V
Uniform convergence , Sequence and series of function – pointwise and uniform convergence , Weirstrass M- Test, Abel's and Drichlet's Test for uniform convergence of series of functions . Continuity of the sum functions of the limit functions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

1.A course of Mathematical Analysis, Shanti Narayan, S.Chand and Co. NewDelhi, 1995.
2. Mathematical Analysis, T.M. Apostol, Norosa Publishing House, New Delhi, 2000.
3. Real Analysis and Metric spaces, K.C.Sarangi, Ramesh Book Depot, Jaipur, 2006.

References:

1. An introduction to Real Analysis,Jain and Kaushik, S.Chand and Co., New Delhi, 1990.
2. Undergraduate Analysis, S.Lang , Springer-Verlag, 1997.
3. Real Analysis, R.R.Goldberg, Oxford and IBH publishing Company, New Delhi, 1999.

Differential Equations

PAPER CODE: BSP 302 **CREDITS:** 3

Course Objective:
This is a course in ordinary differential equations. The focus of this course will be on the applications of ordinary differential equations (ODE‟s) to problems from the physical, biological, and social sciences. You will find that the tools we develop this semester are used by researchers in every branch of science. You should also be aware that we will rely on material you have studied in prior courses. In particular, your skills in algebra and calculus should be sharp.
Course Contents:

Module I
Degree and order of a differential equation .Equations of first order and first degree – Variable separable method , Homogeneous and equations reducible to homogeneous form , Linear and equations reducible to linear form.

Module II
Exact differential equations and equation which can be made exact using I.F. First order higher degree equations – solvable for x, y, p. Clairaut's form.

Module III
Linear differential equation with constant coefficients, complimentary function and particular integral. Homogeneous linear differential equations with variable coefficient. Simultaneous differential equations.

Module IV
Linear differential equations of second order- Linear independence of solutions . Solution by transformation of the equations by changing the dependent and independent variable. Factorization of operators. Method of variation of parameters, Method of undetermined coefficients.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

1.Introductory course on Differential Equations, D.A.Murray, Orient Longman, 2004
2. Elements of Partial Differential Equations, I. N. Sneddon, TMH, 2001
3. Differential Equations & their applications, Zafar Ahsan, PHI ,New Delhi, 1998.
4. Differential Equations, Bansal and Dhami, vol. I, JPH, 2012.

References:

1.A Treatise on Differential Equations, A.R. Forsyth, Macmillan and Co. Ltd, London, 1997.
2. Theory and Problems of Differential Equations, Frank Ayres, TMH, 2002.

Thermodynamics and statistical physics

Paper Code : BSP303 **Credit - 02**

OBJECTIVE:

To acquaint the students with basic laws of thermodynamics and statistical physics, methods of producing low temperatures, Carnot's engine so that they develop the scientific attitude to relate this knowledge to their daily life experiences.

MODULE I:

Basic Thermodynamics:

The Zeroth law, Various indicator diagrams (P-V diagram), First law of thermodynamics, Reversible and irreversible processes, Carnot's engine, Carnot's cycle and efficiency of Carnot's engine, reversibility of Carnot's engine, Carnot's theorem. Second law of thermodynamics, (different statements and their equivalence) Entropy, Principle of increase of entropy, Thermodynamic scale of temperature, Thermodynamic scale as an absolute scale, Third law of thermodynamics.

MODULE II:

Thermodynamic Relations:

Maxwell's thermodynamic relations, Triple point, ClausiusClapyron latent heat equation,Effect of pressure on boiling point of liquids, Helmholtz free energy, Enthalpy, Gibbs function,Internal energy,Thermodynamic potentials, Deduction of Maxwell's relations from thermodynamic potentials.

MODULE III:

Distribution of molecular velocities:

Distribution law of molecular velocities, Most probable, Average and RMS velocities, energy distribution function, Experimental verification of Maxwell velocity distribution, Principle of equipartition of energy.Mean free path and collision cross section, distribution of mean free path, Transport of mass, momentum and energy and their interrelationship.

MODULE IV:

Classical Statistics and Quantum Statistics

Classical Statistics:

Phase space, micro and macro states, Thermodynamic probability, relation between entropy and thermodynamic probability, Monatomic ideal gas, specific heat capacity of diatomic gas and specific heat of solids.

Quantum Statistics:

Failure of classical statistics (Blackbody radiation and various laws of distribution of radiation, qualitative discussion of Weins and Rayleigh Jeans Law) Postulates of quantum statistics, Indistinguishability of wave function and exchange degeneracy, Bose Einstein statistics and its distribution function, Planck's distribution function and radiation formula, Fermi Dirac statistics and its distribution function.

ESSENTIAL READINGS:

1. “Heat and Thermodynamics”, Singhal, Agarwal and Prakash ,PragatiPrakashan.
2. “Heat and Thermodynamics”, Brijlal andSubramaniam, S. Chand & Sons.
3. “Thermodynamics and Statistical Mechanics”, S.L.Kakani, Sultan Chand & Sons.

REFERENCES:

1. “Statistical and Thermal Physics”, S. Loknathan and R.S. Gambhir, Prentice Hall, New Delhi 1991.
2. “Thermodynamics, kinetic theory of gases and Statistical Mechanics”, F.W.Sears, G.L.Salinger, Narosa Pub. House.
3. “Introduction to Statistical Mechanics”, B.B. Laud, Mc Milan India Ltd.
4. “Fundamentals of Statistical and Thermal Physics”, FederickReif, Tata McGraw Hill, 1992.
5. “Heat and Thermodynamics”, M.S.Yadav, Anmol Publications.
6. “Fundamentals of Statistical Physics”, A.K. Das Gupta, New Central Book Company, Calcutta.

Electronics

Paper Code : BSP304 **Credit -02**

OBJECTIVE:

This course aims to develop the fundamental knowledge of electronics by learning various topics viz. circuit analysis, network theorems, P-N diode equation, rectifiers, filters, transistors and transistor amplifiers and their analysis. Students will also learn feedback amplifiers.

MODULE I:

Basic Circuit Analysis:

Impedance, Admittance and Hybrid parameters of any four terminal network, Kirchoff's laws, Mesh and Node analysis.

Various Circuit theorems:

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transformer theorem and Reciprocity theorem.

MODULE II:

Semi conductor diode and rectification:

p-n junction diodes, I-V characteristics, diode as a rectifier, half-wave and full-wave rectifiers:calculations of ripple factor, efficiency and regulation, bridge rectifiers.

Filters: Series inductor, shunt capacitor, L-section and p section filters.

Voltage regulation: Zener diode, breakdown voltage (avalanche and zener effect), voltage regulation, voltage multipliers

MODULE III:

BJT and amplifiers:

Basic construction of pnp and npn transistors and their operation, Input and output characteristics of CB, CC and CE configurations, active, saturation and cut-off regions, Load line and Q-point, Two-port analysis of a transistor using h-parameters, Analysis of CB, CE and CC amplifier for current gain, voltage gain, input and output impedances using h-parameters,Gain-frequency response of an amplifier.

MODULE IV:

Feed-back amplifier:

Concept of feed-back, positive and negative feedback, voltage and current feedback circuits (series and parallel circuits).Advantages of negative feedback: Stabilization of gain, effect on input and output impedances, reduction of non-linear distortion, effect on gain-frequency response.Oscillators: Barkhausen criterion, RC oscillators, Colpitt's oscillator, Hartley oscillator, crystal oscillators.

ESSENTIAL READINGS:

1. "Electronic Devices and Circuits", Jacob Millman and Christos Halkias, TMH , 9th edition.
2. "Electronic Fundamentals and Applications", John D. Ryder, Prentice Hall of India Pvt. Ltd.,(1983)

New Delhi.
3. "Hand book of Electronics", Kumar and Gupta, PragatiPrakashan, Meerut.

REFERENCES:

1. "Basic Electronics and Solid State", B.L. Theraja, S.Chand, 2002.
2. "Integrated Electronics, Analog and Digital circuits and systems", Millman&Halkias, McGraw Hill Ltd. (1972).
3. "Electronic devices and circuits" ,Soni and Gupta, DhanpatRai and Sons.
4. "Basic Electronics and Linear circuits", Bhargava and Kulshreshtha, TMH ,1984.
5. "Principle of Electronics" (for numerical problems) V.K. Mehta, S.Chand ,2002.
6. "Basic Electronics", Kal, Prentice Hall of India, 2002.
7. "Electronic Devices and Circuit Theory", Robert Boylestad and Nashelsky, Prentice Hall ofIndia, Fifth edition.
8. "Engineering Electronics", John D Ryder, McGraw Hill Book Co.

PHYSICS LAB-III

Paper Code : BSP 305 **Credit : 02**

Course Contents:

1. To determine a Low Resistance by Carey Foster's Bridge.
2. To determine a Low Resistance by a Potentiometer.
3. To determine High Resistance by Leakage of a Capacitor.4.To investigate the Motion of Coupled Oscillators.
4. To study the response curve of a Series LCR circuit and determine its (a) Resonant
5. Frequency, (b) Impedance at Resonance and (c) Quality Factor Q, and (d) Band Width.
6. To study the response curve of a Parallel LCR circuit and determine its (a) Anti-
7. Resonant Frequency and (b) Quality Factor Q.
8. To study (a) Half-wave Rectifier and (b) Full-wave Bridge Rectifier.
9. To study the Forward and Reverse characteristics of a Zener Diode and to study its use as a Voltage Regulator.
10. To study the CE Characteristics of a PNP Transistor.
11. To study the characteristics curves of PN junction diode in forward and reversed bias

To study the Frequency Response of Voltage Gain of a RC-Coupled Amplifier.

Any other experiment carried out in the class.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Course Inorganic Chemistry-I
BSP 306 Credits: 02
Module I
Chemistry of Elements of first Transition Series : Characteristics properties of d-Block elements. Properties of the elements of the first transition series, their Binary Compunds and complexes. Illustrating relative stability of their oxidation states, Coordination number and geometry.
Module II
Chemistry of Elements of Second and Third Transition Series : General characteristics, comparative treatment with their 3d-analogues in respect of ionicRadii, Oxidation States, magnetic, behaviour, Spectral properties, Stereo-chemistry.
Module III
Coordination Compounds: Werner's coordination theory and its experimental verification, Effective atomic number concept, Chelates, Nomenclature of coordination Compounds, Isomerism in coordination compounds, valence bond theory of transition metal complexes.
Books Suggested:
1. Text book of Quantitative Inorganic Analysis: A. I. Vogel (Chapter – I, II and XXIII)
2. Text book of Quantitative Inorganic Analysis: I. M. Kothoff and E. R. Sandell
3. Concise Inorganic Chemistry: J. D. Lee
4. General Inorganic Chemistry: J. A. Duffy
5. Principle of Inorganic Chemistry: B. R. Puri and L. R. Sharma
6. Basic Inorganic Chemistry: Cotton and Wilkinson and Gaus, Willey

Examination Scheme For Exams:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Course:General Organic Chemistry-I CHY302 Credits: 02
Module I
Alcohols: Classification and nomenclature. Monohydric alcohols - Nomenclature, Method of formation by Reduction of aldehydes, Ketones,Carboxylic acids and esters, Hydrogen bonding, Acidic nature, Reactions of alcohols, Dihydric Alcohols - Nomenclature, methods of formation, Chemical reaction of vicinal glycols, Oxidative-Cleavage [Pb $(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement. Trihydric Alcohols - Nomenclature and methods of formation, chemical reactions of glycerol.
Phenols: Nomenclature, Structure and bonding, Preparation of Phenols, Physical Properties and acidic character, Comparative acidic strengths of alcohols and phenols, Resonance stabilization of phenoxide ion, Reactions of phenols: electrophylic aromatic substitution, acylation and carboxylation, mechanism of fries rearrangement, Claisen rearrangement, gatter-man synthesis. Hauben- HoeschReaction, Lederer-manasse reaction and Reimer-tiemann Reaction.
Module II
Aldehydes And Ketones: Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3Dithianes synthesis of ketones from nitriles and from carboxylic acids. Physical properties, Mechanism of Nucleo-philic additions to carbonyl, aldol, perkin and Knoevenagel condensations, Condensation with ammonia and its Derivatives, Wittig reaction, Mannich reaction. Use of acetals as Protecting group Oxidation of aldehydes, baeyer-villiger oxidation of ketone, cannizzaro's reaction, MPV, Clemmensen, Wolff-kishner, Li AlH4 reductions, Halogenation of enolizable ketones, An introduction to O□O Unsaturated aldehydes and ketones.
Books Suggested:
1. A Text Book of Organic Chemistry: K. S. Tiwari, S. N. Mehrotra and N. K. Vishnoi
2. Modern Principles of Organic Chemistry: M. K. Jain & S. C. Sharma
3. A Text Book of Organic Chemistry: (Vol. I & II) O. P. Agarwal
4. A Text Book of Organic Chemistry: B. S. Bahl and ArunBahl
5. A Text Book of Organic Chemistry: P. L. Soni
6. Organic Chemistry: (Vol. I, II & III) S. M. Mukherji, S. P. Singh and R P. Kapoor

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Course:General Organic Chemistry-I
BSP307 Credits: 02
Module I
Alcohols: Classification and nomenclature. Monohydric alcohols - Nomenclature, Method of formation by Reduction of aldehydes, Ketones,Carboxylic acids and esters, Hydrogen bonding, Acidic nature, Reactions of alcohols, Dihydric Alcohols - Nomenclature, methods of formation, Chemical reaction of vicinal glycols, Oxidative-Cleavage [Pb $(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement. Trihydric Alcohols - Nomenclature and methods of formation, chemical reactions of glycerol.
Phenols: Nomenclature, Structure and bonding, Preparation of Phenols, Physical Properties and acidic character, Comparative acidic strengths of alcohols and phenols, Resonance stabilization of phenoxide ion, Reactions of phenols: electrophylic aromatic substitution, acylation and carboxylation, mechanism of fries rearrangement, Claisen rearrangement, gatter-man synthesis. Hauben- HoeschReaction, Lederer-manasse reaction and Reimer-tiemann Reaction.
Module II
Aldehydes And Ketones: Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3Dithianes synthesis of ketones from nitriles and from carboxylic acids. Physical properties, Mechanism of Nucleo-philic additions to carbonyl, aldol, perkin and Knoevenagel condensations, Condensation with ammonia and its Derivatives, Wittig reaction, Mannich reaction. Use of acetals as Protecting group Oxidation of aldehydes, baeyer-villiger oxidation of ketone, cannizzaro's reaction, MPV, Clemmensen, Wolff-kishner, Li AlH4 reductions, Halogenation of enolizable ketones, An introduction to O□O Unsaturated aldehydes and ketones.
Books Suggested:
1. A Text Book of Organic Chemistry: K. S. Tiwari, S. N. Mehrotra and N. K. Vishnoi
2. Modern Principles of Organic Chemistry: M. K. Jain & S. C. Sharma
3. A Text Book of Organic Chemistry: (Vol. I & II) O. P. Agarwal
4. A Text Book of Organic Chemistry: B. S. Bahl and ArunBahl
5. A Text Book of Organic Chemistry: P. L. Soni
6. Organic Chemistry: (Vol. I, II & III) S. M. Mukherji, S. P. Singh and R P. Kapoor

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

CHEMISTRY LAB-III

BSP308 **Credit: 2**

NOTE: Students are expected to perform any eight experiments from the given list. The duration of the Practical Examination shall be 4 hours. The distribution of marks in the practical examination will be as follows:

1. Three experiments: 20 Mark each.
2. Distribution of marks will be as follows:
   - Figure /Formula/Theory : 5
   - Observations/Calculations : 8
   - Result /Result Analysis : 5
   - Precautions : 2
3. Viva -Voce : 10

List of Experiments:

1. Quantitative analysis
2. Volumetric analysis
   - Determination of acetic acid in commercial vinegar. Using NaOH
   - Determination of Alkali content in Anta-acid tablet Using HCl.
   - Estimation of calcium content in chalk as calcium oxalate by permangano-metry.
   - Estimation of hardness of water by EDTA.
   - Estimation of ferrous and ferric by dichromate method.
   - Estimation of copper using thiosulphate.
3. Qualitative analysis:
   - Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives
4. Thermo chemistry:
   - To determine the solubilies of benzoic acid at different temperatures and to determine OH of the dissolution process
   - To determine the enthalpy of neutralization of a weak acid weak base verses strong acid and strong base and determine the enthalpy of ionisation of the weak acid/weak base.
   - To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using born haber cycle.

Books Suggested:

1. Practical Chemistry: GiriBajpai and Pandey, S. Chand & Co. Ltd., New Delhi
2. Practical Chemistry (Hindi Ed.): Suresh Ameta& P. B. Punjabi, Himanshu Publication

FOURTH SEMESTER

Dynamics

PAPER CODE: BSP 401 **CREDITS:** 3

Course Objective:
This Course introduces students to the analysis of dynamic systems encountered in engineering design practice. As a result, students will develop a clear understanding of the basic principles that govern the dynamics of particles and rigid bodies; as well as an ability to use that Understanding in the solution of so many problems.

Course Contents:

Module I
Velocity and acceleration-along radial and transverse directions, along tangential and normal directions, S.H.M. – Hooke's Law, Horizontal and vertical elastic strings.

Module II
Motion in a resisting medium-Resistance varies as velocity and square of velocity, Work and Energy, Motion on a smooth curve in a vertical plane, Motion on the inside and outside of a smooth vertical circle.

Module III

Central orbits-p-r equations, Apses, time in an orbit, Kepler's law of planetary motion.

Module IV
Constrained motion in two dimensions: Motion of a particle on the inside and outside of a smooth vertical circle.

Module V
Moment of Inertia: Moment of inertia of a rod, Rectangular lamina, Circular ring and circular disc, Hollow and solid spheres, Cylinder, Theorem of perpendicular and parallel axis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

1. Dynamics , Ramsey A.S. , CBS Publishers and distributors
2. Dynamics , Bali , Laxmi Publications,Meeerut
3. Dynamics , M.Ray, S. Chand & Co.
4. Statics ,Dynamics,Gokhroo&Gokhroo,Navkar Prakashan Ajmer.s

References:

1. Dynamics of a Particle, Loney, Macmillan India Ltd.
2. Principles of mechanics , J. L. Synge and B. A. Griffith, New York andLondon,McGraw-Hill,1942.
3. Dynamics of a Particle, Ray , Students Friends and Co., Agra,1981
4. Dynamics of a Particle, Vasishtha A.R., Gupta, Krishna Prakhasan Mandir,2014
5. Dynamics, Y.N.Gaur, A.K.Mathur,M.C.Goyal,RBD, 2015
6. Elements of Dynamics,Gokhroo,Saini,Arora JPH,2014

Numerical Analysis

PAPER CODE: BSP 402 **CREDITS:** 3

Course Objective:
This course deals with the techniques of numerical analysis, which gives the solution to applied problem when ordinary analytical method fails. Emphasis is given on computer programming also so that the given techniques can be used in design of engineering and scientific problems.

Course Contents:

Module I
Differences, Relation between differences and derivatives, difference of polynomials, Factorial notation, Newton's forward and backward interpolation formula (including proof).

Module II

Divided differences: Newton's and Lagrange's divided differences formulae, Central differences: Gauss's, Stirling's and Bessel's interpolation formulae.

Module III

Numerical differentiation, Numerical integration – Quadrature formula-trapezoidal rule, Simpson's 1/3 rd and 3/8 th formulae, Gaussian Integration, Newton cotes formula.

Module IV

Inverse Interpolation, Numerical solution of algebraic and transcendental equations- Bisection method , Regula-falsi method, Method of iteration and Newton Raphson's Method, Newton's iterative formula for obtaining square and inverse square roots.

Module V
Solution of system of linear equations: Gauss elimination method, Jacobi and Gauss Seidal method, Solutions of ordinary differential equations with initial boundary conditions: Picard's method, Euler's and modified Euler's method, Runge's Kutta Method.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Note: Non Programmable scientific calculator up to 100 MS is permitted.

1. Calculus of Finite Differences and Numerical Analysis, Gupta and Malik, Krishna Prakashan Mandir,2013
2. Numerical Methods Problems and Solutions, M.K. Jain, Iyengar, New Age International Ltd.,2007
3. Numerical Analysis, Sharma & Sharma, Ratan Prakashan Mandir, Agra,IInd edition,1989
4. Numerical Mathematical Analysis, Scarborough, James B., Oxford and IBH publishing co.,6th edition,1966

References:

1. Applied Numerical Analysis , Gerald, Addison Wesley Publishing Company,2009
2. Applied Numerical Methods, Gourdin; Boumahrat, Prentice Hall of India,1996
3. Numerical Methods Problems and Solutions , M.K.Jain, Iyengar,New Age International Ltd,2007
4. Numerical Analysis a Practical Approach , Melvin J.Maron, Robert J.Lopez, Machmillon , Publishing Company, New York, 3rd Edition ,1991
5. Finite differences& Numerical analysis, H.C.Saxena, S.Chand & Co.New Delhi,2010

Mathematical Physics
Paper Code BSP403 Credit -02

OBJECTIVE:

This course aims at exposing the students to basic Mathematics which will be useful for them to solve the problems of Physics.

Module I: Vector Calculus

Dot and cross product of vectors, Gradient, divergence and curl, their physical significance, Laplacian, vector identities, Line integral, surface integral and volume integral, Gauss divergence theorem, Stokes theorem.

Module II: Infinite Series and Fourier Series:

Infinite series: Fundamental concepts, convergence tests, alternating series, algebra of series, power series, Taylor series.
Fourier Series: Periodic functions, Fourier series, Euler's formulae, Even functions, Half range series, Change of interval and functions having arbitrary period, practical harmonics analysis.

Module III: Differential Equations

Differential equations with examples from Physics, their degree and order, Linear Differential equations, solution of 1^{st} and 2^{nd} order differential equations. Standard integrals and their applications in Physics.

Module IV: Curvilinear coordinates:

Orthogonal curvilinear coordinates, line element, gradient, divergence and curl in curvilinear coordinates, Cartesian coordinate system, Polar coordinates, Cylindrical coordinate system, Spherical polar coordinate system.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Mathematical Methods in the Physical Sciences : M.L.Boas (Wiley) (2002).
- Introduction to Mathematical Physics : C. Harper (Prentice Hall of India) (2004).
- Vector Analysis - M. R. Spiegel, (Schaum's Outline Series) (Tata McGraw-Hill).
- Mathematical Physics – P.K. Chattopadhyay (Wiley Eastern).

Solid State Physics and Devices
Paper Code : BSP404 Credit- 02

OBJECTIVE:

To familiarize the students with the basics of condensed matter physics which form the basic for further studies in condensed matter physics. The students get acquainted with the crystal structure, properties of solids, superconductivity and magnetism which strengthen the theoretical base for research in contemporary fields of condensed matter physics like imperfect solids and nano particle physics..

MODULE I:

Crystal structure: Symmetry elements in crystal, Unit cell, fundamental lattice system and types, Miller indices, crystal structures of simple cubic, FCC, BCC, HCP, diamond. **Crystal Diffraction:** Bragg's law, X-ray and neutron diffraction, Rotating crystal method, laue Method and Powder method.

MODULE II:

Thermal Properties of solids: Concepts of thermal energy and Phonons, Einstein theory of specific heat, Debye model of lattice specific heat.

Band theory of solids: Formation of bands, distinction between metals, insulators and semiconductors, periodic potential of a solid, wave function in a periodic lattice and Bloch theorem, Physical origin of effective mass,negative effective mass and holes.

MODULE III:

Electrical conductivity: Drude Lorentz theory of electrical conductivity. Sommerfield theory of conduction in metals, The Hall effect.
Superconductivity: Zero resistivity, Critical temperature, critical magnetic field, Meissner effect, Type I and type II superconductors, BCS theory (Basic idea),High Tc superconductors.

MODULE IV:

Magnetic Properties: Classification of magnetic material, Diamagnetism, Paramagnetism due to free ions and conduction electrons, Curie's law, ferromagnetismNature and Origin of Weiss molecular field. Domains, hysterisis loop, outline of antiferromagnetism andferrimagnetisms, ferrites.

MODULE V:

Solid State Devices: Light emitting diode, Solar cell, SCR.

Operational amplifier: Differential amplifiers, differential gain and CMRR, inverting and non-inverting configurations Applications of op-amp: adder, subtractor, differentiator and integrator. **Field affect Transistor (FET):** Classification of various types of FET, constructional details of FET, drain characteristics and baising of FET, operating regions, pinch-off voltage, idea of metal oxide semiconductor field effect transistor (MOSFET).

ESSENTIAL READINGS:

1. "Introduction to Solid State Physics", C. Kittel, Wiley Eastern, New Delhi, Seventh Edition.

2. “Solid State Physics”, S.O. Pillai, 3rd edition 1999, New Age International, New Delhi.

3. "ElectronicDevices&Circuit Theory",Boylestad&Nashelsky , Prentice Hall of India.

REFERENCES:

1. "Solid state physics", A.J Dekker ,Macmilan India Ltd.
2. "Solid state Physics", R.L. Singhal, KedarNath Ram Nath Publishers, 2001.
3. "Theory of solids", L. Azaraf, Tata Mc.Graw Hill Publishing Co.
4. "Solid State Physics", S.L. Gupta and V.Kumar, KedarNathRamNath& Co., Meerut
5. "Electronic Devices and Circuits" ,Soni,Gupta , DhanpatRai and Sons.
6. "Elements of Solid State Physics", J.P.Srivastava, Prentice Hall of India, New Delhi.

PHYSICS LAB-IV

Paper code : BSP405 Credit Units: 02

Course Contents:

1. To investigate the use of an op-amp as an Integrator.
2. To investigate the use of an op-amp as a Differentiator.
3. To study Amplitude Modulation using Transistor.
4. To study Pulse Width / Pulse Position and Pulse Amplitude Modulation using ICs.
5. To verify the basic logic gates using logic gate trainer kit.
6. To design and verify the following digital circuits using basic gates:
   i) S-R flip-flops , ii) J-K flip-flops.
7. To execute half adders and full adders with basic gates and hence to verify addition of binary numbers.
8. To determine the value of e/m by Thomson's method.

Any other experiment carried out in the class.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Course:Chemistry of States of Matter
BSP 406 Credits: 02
Module I
Solid State
Definition of space lattice, unit cell, Laws of crystallography- (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry, Symmetry elements in crystals. X-ray diffraction by crystals, Derivation of Bragg's equation Determination of Crystal structure of NaCl and CsCl(Laue's method and powder method.)

Module II
Gaseous States
Postulates of kinetic theory of gases, deviation from ideal behaviour, vanderwaals equation of state. Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of vander Waals equation, relationship between critical constants and vanderwaals constants, the law of corresponding states, reduced equation of state. Molecular Velocities: Root mean square, average and most probable velocities. Qualitative discussions of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect)
Module III
Liquid state
Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases, Liquid Crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and cholestric phases, Thermography and seven segment cell.
Colloidal State
Definition of colloids, classification of colloids, Solids in liquids (sols) properties- kinetic, optical and electrical, stability of colloids, Protective action, Hardy-Schulze law, gold number, Liquids in liquids (emulsions): types of emulsions, preparation, Emulsifier, Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.
Books Suggested:
1. Principles of Physical Chemistry: B. R. Puri and L. R. Sharma
2. A Text Book of Physical Chemistry: A. S. Negi and S. C. Anand
3. Physical Chemistry, Pt. I & II: C. M. Gupta, J. K. Saxena and M. C. Purohit
4. Computers and Applications to Chemistry: Ramesh Kumari, Narosa Publishing House P. Ltd.
5. A Text Book of Physical Chemistry : Kundu and Jain

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Course:GeneralOrganic Chemistry II
BSP407 Credits:02
Module I
Ethers And Epoxides: Nomenclature of ethers and methods of formation, physical properties. Chemical reaction, cleavage and autoxidation, ziesel's method of synthesis of epoxides, Acid and Base catalyzedring opening, Reactions of Grignard and organolithium reagents with epoxides.

Module II
Carboxylic Acids: Nomenclature structure and bonding, Physical properties, Acidity of carboxylic acids, Effect of subsituents on acid Strength, preparation of carboxylic acids, Reactions of carboxylic acids, Hell-Volhardzelinsky reaction, Synthesis of acid chlorides, Esters and amides. Reductions of carboxylic acids, Mechanism of decarboxylation, Methods of formation and chemical reactions of unsaturated mono carboxylic acids, Dicarboxylic Acids: Methods of Synthesis and effect of heat and dehydrating agents.
Carboxylic Acid Derivatives: Structure and nomenclature of acid chlorides, Esters, Amides and acid- anhydrides, Relative stability and reactivity of acid derivatives, physical properties, Inter conversion of acid derivatives by nucleophilic acyl substitution, preparation of carboxylic acid derivatives, chemical reactions, mechanism of esterification and hydrolysis (Acidic and Basic)
Module III
Organic Compounds of Nitrogen: Preparation of nitro alkanes and nitro arenes. Chemical Reactions of Nitro alkanes, Mechanism of nucleophilic substitution in nitro arenes and their reduction in acidic, neutral and alkaline media, Picric Acid
Alkyl and aryl amines: Reactivity, Structure and nomenclature of amines, physical properties. Stereo chemistry of amines, Separation of a mixture of primary, secondary and tertiary amines .Structural features, effecting basicity of amines. Amine salts as phase- transfer catalysts, preparation of alkyl and aryl amines (Reduction of nitro compounds, Nitriles) Reductive amination of aldehydic and ketonic compounds, Gabriel-Phthalimide reaction, Hofmann bromamide Reaction, Reactions of amines, Electrophilic Aromatic substitution in arylamines, Reactions of amines with nitrous acid, Synthetic transformations of aryl- diazonium salts, azo couplin.
Books Suggested:
1. A Text Book of Organic Chemistry: K. S. Tiwari, S. N. Mehrotra and N. K. Vishnoi
2. Modern Principles of Organic Chemistry: M. K. Jain & S. C. Sharma
3. A Text Book of Organic Chemistry: (Vol. I & II) O. P. Agarwal
4. A Text Book of Organic Chemistry: B. S. Bahl and ArunBahl
5. A Text Book of Organic Chemistry: P. L. Soni
6. Organic Chemistry: (Vol. I, II & III) S. M. Mukherji, S. P. Singh and R P. Kapoor

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Elective Course Name: Nuclear/Radio chemistry
BSP411 Credits 3
Module I
Some Important Compounds of p-block elements: Hydrides of boron, diborane and higher boranes, borazine, borohydride, fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphurtetranitride, basic properties of halogens, interhalogens and polyhalides
Chemistry of Noble gases: Chemical properties of the noble gases, chemistry of xenon, structure and bonding in Xenon compounds
Module II
Nuclear Chemistry: Fundamental principles of nucleaus (nucleons), concepts of nuclides and its representation, isotopes, isobars and isotones (with specific examples), forces operating between nucleons (n-n, n-p, p-p), qualitative idea of stability of nucleaus (n/p ratio)
Module III
Radiochemistry: Natural and artificial radioactivity, radioactive disintegration series, radioactive displacement law, radioactivity decay rates, half life and average life, nuclear binding energy, mass defect and calculation of defect and binding energy, nuclear reactions, spallation, nuclear fission and fusion
Books suggested:
1. Concise Inorganic Chemistry: J. D. Lee
2. General Inorganic Chemistry: J. A. Duffy, Longman (2nd Ed.)
3. Principles of Inorganic Chemistry: B. R. Puri and L. R. Sharma
4. Basic Inorganic Chemistry: F. A. Cotton and G. Wilkinson, Wiley Eastern
5. Molecular Geometry: R. J. Gillespie, Van Nostrand Reinhold

Examination Scheme

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

CHEMISTRY LAB IV
BSP408 Credit: 2
NOTE: Students are expected to perform any eight experiments from the given list. The duration of the Practical Examination shall be 4 hours. The distribution of marks in the practical examination will be as follows:

1. Three experiments: 20 Mark each.
2. Distribution of marks will be as follows:
   Figure /Formula/Theory : 5
   Observations/Calculations : 8
   Result /Result Analysis : 5
   Precautions : 2
3. Viva -Voce : 10

1. Calibration of fractional weights, pipettes and burettes, preparation of standard solution, dilution- 0.1 M to 0.001 M solutions.
2. Gravimetric analysis: Analysis of copper (cu) as CuSCN and Ni as Ni Dimethyl glyoxime.
3. Thin layer Chromatography

- Determination of Rf values and identification of organic compounds.
- Separation of green leaf pigments (spinach leaves may be used)
- Preparation and seperation of 2,4-Dinitro -Phenyl Hydra-Zones of acetone, 2-butanone, hexan-2 and 3-one using toluene and light petroleum (40:60)
- Separation of a mixture of dyes using cyclohexane and Ethyl acetate (8.5 : 1.5)

4. Paper Chromatography:

- Separation of a mixture of phenyl alanine and glycine, Alanine and aspartic acid, leucine and glutamic acid, spray reagent-Ninhydrin.
- Separation of a mixture of D,L- alanine, glycine, and L-leucine using n-butanol: acetic acid:water (4:1:5) spray reagent-aniline hydrogen phthalate.
- Separation of mono saccharides- a mixture of D-galactose and D-fructose using n-butanol:acetone: water (4:1:5) spray reagent- aniline hydrogen phthalate.

5. Transition temperature Determination of the transition temperature of the given substance by thermo-metric/dialometric method (e.g. $MnCl_2.4H_2O$/ $SrBr_2.2H_2O$)
6. Phase Equilibrium

- To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g.Phenol- water system)
- To construct the phase diagram of two component(e.g.Diphenyl- Benzophenone) system by cooling curve method.

Books Suggested:

1. Practical Chemistry: GiriBajpai and Pandey, S. Chand & Co. Ltd., New Delhi
2. Practical Chemistry (Hindi Ed.): Suresh Ameta& P. B. Punjabi, Himanshu Publication

FIFTH SEMESTER

Metric and Vector Space

PAPER CODE: BSP 501 **CREDITS:** 3

Course Objective:

To gain proficiency in dealing with abstract concepts, with emphasis on clear explanations of such concepts to others. To gain proficiency in the art of writing proofs. To gain familiarity with the concepts of "metric and vector space" and to see how these provide a context in which standard concepts of mathematical analysis, such as convergence and continuity, can be studied. To understand the concepts of completeness and compactness of metric spaces. To understand the Contraction Mapping Theorem, and see how it can be applied to prove the existence of solutions of equations of various kinds.

Course Contents:

Module I

Metric Space: Definition with examples, Bounded set, Open set, closed sets, Neighbourhoods Boundary points and limit points, Exterior point, Closure of a set, Metric Subspace.

Module II

Continuous mappings, Sequence in a Metric Space, Cauchy Sequence, Subsequence, Completeness of Metric Space.

Module III

Separable Space, Compact spaces and Compact Sets, Connected Spaces and Connected Sets, Bolzano's Theorem, Product Spaces.

Module IV

Vector Spaces, Definition, examples and basic properties. Subspaces. Linear independence. Linear combinations and span. Basis and dimension. Sum and intersection of subspaces. Direct sum of subspaces.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

1. Real Analysis and Metric Space, K. C. Sarangi, RBD, Jaipur.
2. Basic Abstract Algebra, P. B. Bhattacharya , S. K. Jain and S. R. Nagpaul,Basic Cambridge University Press.
3. Modern Algebra, G. C. Sharma, Shivlal Agarwal & Co. Agra.

References:

1. Abstract Algebra, Deepak Chatterjee, PHI. Ltd. New Delhi.
2. Topics in Algebra, I.N. Herstein, Wiley Eastern Ltd., New Delhi

Operations Research

PAPER CODE: BSP502 **CREDITS:**3

Course Objective:

The problems in optimization are the most common applications of mathematics. The main aim of this course is to present different methods of solving optimization problems in the areas of linear programming, non linear programming, and integer linear programming. In addition to theoretical treatments, there will be some introduction to numerical methods for optimization problems.

Course Contents:

Module I

Introduction, objective of OR, scope of OR. General Linear Programming problem: Formulation of the problem- Graphical method for the solution of the L.P.P., Spanning set, Basis set, Basic solution, Basic feasible solution, Convex set, Convex combination, Extreme points.

Module II

Simplex Method for Linear Programming, Big M method and two phase Method. Dual Linear Programming Problem, Rules for Constructing the Dual from Primal, Solution of Duality.

Module III

Transportation problem: Optimality test. Degeneracy in transportation problem. Unbalanced transportation problems. Assignment problems.

Module IV

Basic Idea of PERT & CRM, Difference between PERT & CPM, PERT/CPM Network Components and Precedence Relationship Critical Path Analysis, Project Scheduling, Project Time-Cost, Trade-Off, Resource Allocation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

1. Operations Research Kanti Swaroop, Gupta P.K. and Manmohan , Sultan Chand and sons ,2002
2. Operations Research an introduction , H.A.Taha , Macmillan Publishing Company , New York.,10th Edition,2017
3. Operations Research , Sharma & Jain, Students friends & Co.,5thEdition,2013
4. Operations research Theory, Methods and Applications, S.D. Sharma, Kedarnath & Ramnath Co., Meerut,2012

References:

1. Linear Programming Methods and Applications, S.I., Gauss, MaGraw Hills Book Company,5th edition.
2. Problems in O.R. Gupta P.K. and Hira D.S., S.Chand and Co.,2010
3. Introduction to Operations Research, Hillier & Lieberman,7th Edition,2001

Quantum Physics

PAPER CODE:BSP503 Credit - 02

OBJECTIVE:

: This paper aims to develop the basic knowledge of quantum mechanics and its application to various problems. It also deals with the techniques of wave mechanics like Schrödinger equation and its solution, angular momentum and spin.

MODULE I:

Introduction to Wave mechanics and Schrodinger equation:

Introduction to Wave mechanics :

Duality of radiation and matter, De broglie's hypothesis, Davisson and Germer experiment, Uncertainty principle relating to position and momentum, relating to energy and time, its applications to various quantum mechanical problems

MODULE II:

Schrodinger equation:

Wave function and its interpretation, Schrödinger time dependent and time independent one-dimensional and three-dimensional wave equation, probability current density, physical meaning of ψ, conditions to be satisfied by ψ. Operators, eigen values and eigen functions, operators for momentum, K.E., Hamiltonian, total energy and angular momentum, Fundamental postulates of Q.M.Hermitian operators,

MODULE III:

Simple solutions of Schrödinger equation and Boundary value problems:

Boundary and continuity conditions on the wave function, Particle in one dimensional box, discrete energy levels, generalization to 3-D and degeneracy of levels.

Boundary value problems:

Step potential, Penetration through rectangular barrier, calculation of reflection and transmission coefficientsand resonant scattering, Quantum mechanical tunneling, Square well potential problem,

MODULE IV:

Simple harmonic oscillator

Simple harmonic oscillator (1-D Case): Schrödinger equation and its solutions, eigen function, energy eigen values. Zero point energy, parity, symmetric and anti-symmetric wave functions with graphical representation.

.

ESSENTIAL READINGS:

1. "Quantum mechanics" L.L. Schiff, Tata McGraw Hill.
2. "Quantum mechanics", Chatwal and Anand, Himalaya Publishing House.

3. "Elementary Quantum Mechanics and Spectroscopy" Kakani, Hemrajani and Bansal, College Book House Jaipur.

REFERENCES:

1. "Introduction to Modern Physics",H.S. Mani and G.K. Mehta, East West Press Pvt. Ltd., New Delhi.
2. "Quantum Mechanics", S.P. Singh, M.K. Bagde and Kamal Singh,S. Chand & Co.
3. "Quantum Mechanics", A Listair, I M Rac, ELBS (low price edition).
4. "Quantum Mechanics", S.N.Biswas, Books &Allied,Calcutta (P) Ltd.
5. "Perspectives of Modern physics", A.Beiser, McGraw Hill.

Nuclear and Particle Physics

PAPER CODE: BSP504 Credit-02

OBJECTIVE:

To give the students insight into the fundamentals of nuclear and particle physics.

MODULE I:

Nuclear Properties

Rutherford's theory of a particle scattering, Basic properties: charge, mass, size, spin, magnetic moment, electric quadrupole moment, Parity, Binding energy per nucleon and its observed variation with mass number of the nucleus. Semi empirical mass formula –coulomb energy, volume energy, surface energy, other corrections, explanation of binding energy curve, Liquid drop model,Nuclear forces and their properties, Theory of nuclear forces.

MODULE II:

Nuclear Fission: Energy release in fission, Theory of nuclear fission and liquid drop model, Barrier penetration – Theory of spontaneous fission, Nuclear chain reaction, condition of controlled chain reaction, Principle of nuclear reactors, classification of reactors.

Nuclear Fusion: Energy release in fusion, fusion reactions in stars: carbon and pp cycle.

MODULE III:

Particle Physics: Classification of elementary particles, properties of particles. Fundamental interactions, Conservation laws : Energy,momentum, angular momentum, charge, lepton number, Baryon number, isospin, strangeness, Invariance under charge,parity,C.P.,time and C.P.T.,(Qualitative discussion).

Cosmic rays: Properties of cosmic rays,properties of secondary radiation, electronic showers ,geomagnetic effects, cosmic ray stars, the origin of cosmic rays.

MODULE IV:

Accelerators:

Need for accelerators, Ion sources, Van De graff generator, Drift tube, linear accelerator, Wave guide accelerator, cyclotron ,synchrocyclotron, electron synchrotron, proton synchrotron.

MODULE V:

Detectors: Ionization chamber , Proportional Counter, Geiger Muller Counter, Scintillation counter, Cloud chamber, Bubble chamber, Spark chamber, Solid state detectors.

ESSENTIAL READINGS:

1. "Nuclear Physics", D.C. Tayal, 4th rev. edition. 1992,, Himalaya Publishing, House, Bombay.

REFERENCES:

1. "Atomic Nucleus", R.D. Evans ,McGraw Hill, New York.
2. "Introduction to Elementary Particles", D. Griffiths, Harper and Row, New York, 1987.
3. "Elements of Nuclear Physics", Pandey and Yadav, KedarNath Ram Nath, Meerut, Seventh Edition .
4. "Nuclear Physics : Theory and experiments", R.R. Roy and B.P. Nigam, New Age International (P) Limited.
5. "Radiation Detectors and Measurement", F.Knoll, John Wiley & Sons, Second Edition.

PHYSICS LAB-V

Paper Code : BSP505 Credit Units: 02

Course Contents:

1. To measure the Resistivity of a Ge Crystal with Temperature by Four-Probe Method (from room temperature to 200 ^{0}C) and to determine the Band Gap Eg for it.
2. To determine the Hall Coefficient a Semiconductor.
3. To study the Hysteresis loop (B-H) of ferromagnetic material.
4. To measure the Magnetic susceptibility of Solids and Liquids.
5. To determine the band gap energy of a given semiconductor by four-probe method.
6. To study the characteristics of Photovoltaic cell.
7. To measure the dielectric constant of a ferroelectric material as a function of temperature.
8. To measure magnetic susceptibility of a solution of a paramagnetic salt in water for 3 different concentrations by using Quincke's method.

Any other experiment carried out in the class.

Course: Inorganic Chemistry-II
BSP506 Credits: 02
Module I

Hard and Soft Acids and Bases (HSAB) : Classification of acids and bases as hard and soft, Pearson's HSAB concept acid-base strength and hardness and softness, Symbiosis, theoretical basis of hardness and softness, electro negativity and hardness and softness.

Module II

Metal-Ligand Bonding in Transition Metal complexes: Limitations of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters. Magnetic Properties of Transition Metal Complexes: Types of magnetic behaviour, methods of determining

magnetic susceptibility, spin-only formula, L-S coupling, correlation of μs and μeff and values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

Module III

Organometallic Compounds: Organometallic Compounds: The Grignard reagents-formation, structure and chemical reactions. Organozinc Compounds: Formation and chemical reactions. Organolithium compounds: Formation and chemical reactions. Organosulphur compounds Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

Books Suggested:

1. Basic Inorganic Chemistry F.A. Cotton. G. Wilkinson and P.L. Gaus. Wiley.
2. Concise Inorganic Chemistry, J.D. Lee ELBS.
3. Concepts of Models Inorganic Chemistry B.Douglas. D.McDaniel and J.Alexander, John Wiley.
4. Inorganic Chemistry. D.E. Shriver P.W. Atkins and C.H. Langfor, Oxford.
5. Inorganic Chemistry, W.W. Porterfield Addison Wesley.
6. Inorganic Chemistry, A.G. Sharpe. ELBS.
7. Inorganic Chemistry, G.L. Miessler and D.A. Tarr, Prentice Hall.
8. Group Theory and Its Chemical Applications: P. K. Bhattacharya
9. Inorganic Chemistry: J. E. Huyee, Principles of Structure & Reactivity, 3rd Ed.
10. Selected Topics in Inorganic Chemistry: W. U. Malik, G. D. Tuli and R. Madan
11. Principles of Inorganic Chemistry: D. Banerje
12. Modern Aspect of Inorganic Chemistry: H. J. Emeleus and A. G. Sharpe

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Course: Advance Physical Chemistry
BSP507 Credits: 02

Module I

Photochemistry: Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Drapper law, Stark -Einstein law, Jablonski diagram depicting various processes occuring in the exited sate, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simplex examples).

Module II

Physical Properties and Molecular Structure: Optical activity, polarization - (Calusius-Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties paramagnetism, diamagnetism and ferromagnetics.

Module III

Solutions, Dilute Solutions and Colligative Properties: Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution: colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination, Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure, Elevation of boiling point and depression in freezing point, Experimental methods for determining various colligative properties, Abnormal molar mass, degree of dissociation and association of solutes.

Books Suggested:

1. Physical Chemistry, G.M. Barrow. International Student Edition, McGraw Hill.
2. Basic Programming with Application, V.K. Jain. Tata McGraw Hill.
3. Computers and Common Sense. R Hunt and Shelly, Prentice Hall.
4. University General Chemistry, C.N.R Rao, Mac Millan.
5. Physical Chemistry, RA. Alberty, Wiley Eastern Ltd.
6. The elements of Physical Chemistry, P.W. Atkins, Oxford.
7. Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.
8. Principles of Physical Chemistry: B. R. Puri Sharma and M. S. Pathania
9. A Text Book of Physical Chemistry: A. S. Negi and S. C. Anand
10. A Text Book of Physical Chemistry: Kundu and Jain

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Elective Course: Quantum Chemistry&Spectroscopy-I
BSP511 Credits: 03

Module I

Elementary quantum Mechanics: Black-body, radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's mode of hydrogen atom (no derivation) and its defects. Compton effect. Luis De Broglie hypothesis Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrodinger wave equation for H-atom; separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave, functions.

Module II

Molecular orbital theory: Basic ideas-criteria for forming M.O. from A.O. construction of M.O's by LCAO. H_2^+ ion calculation of energy level from wave functions, physical picture of bonding and anti-bonding wave functions, concept of σ, σ*, π, π* orbitals and their characteristics. Hybrid orbitals - sp, sp^2, sp^3, calculation of coefficients of A. O's used in these hybrid orbitals, Introduction to valence bond model of H_2, comparison of M.O. and V.B. models.

Module III

Spectroscopy: Introduction: Electromagnetic radiation, spectrum, basic features of different spectrometers, statement of the Born-Openheimer approximation, degrees of freedom. Rotational Spectrum: Diatomic molecules, Energy levels of a rigid rotator (semi-classical principles), selection rules, spectral intensity, using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotator, isotope effect.

Vibrational Spectrum: Infrared spectrum : Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Raman Spectrum: concept of polarizability, pure rotational and pure vibrational Raman Spectra of diatomic molecules, selection rules. Electronic Spectrum: Concept of Potential Energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank Condon principle, qualitative description of σ, π and n M.O. their energy levels and the respective transitions.

Books Suggested:

1. Physical Chemistry, G.M. Barrow. International Student Edition, McGraw Hill.
2. Basic Programming with Application, V.K. Jain. Tata McGraw Hill.
3. Computers and Common Sense. R Hunt and Shelly, Prentice Hall.
4. University General Chemistry, C.N.R Rao, Mac Millan.
5. Physical Chemistry, RA. Alberty, Wiley Eastern Ltd.
6. The elements of Physical Chemistry, P.W. Atkins, Oxford.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

CHEMISTRY LAB V

BSP508 **Credit 2**

NOTE: Students are expected to perform any eight experiments from the given list. The duration of the Practical Examination shall be 4 hours. The distribution of marks in the practical examination will be as follows:

1. Three experiments: 20 Mark each.
2. Distribution of marks will be as follows:
   - Figure /Formula/Theory : 5
   - Observations/Calculations : 8
   - Result /Result Analysis : 5
   - Precautions : 2
3. Viva -Voce : 10

1. Synthesis and Analysis

- Preparation of sodium trioxalato ferrate (III) $Na_3[Fe(C_20_4)_3]$ and determination of its composition by permagnomotry.
- Preparation of Ni-DMG complex, $[Ni(DMG)_2]$.
- Preparation of copper tetraammine complex $[Cu(NH_3)_3]S0_4$.
- Preparation of cis-and trans-bisoxalatodiaquachromate (III) ion.

2. Synthesis of Organic Compounds

- Acetylation of salicylic acid aniline, glucose and hydroquinone, Benzoylation of aniline and phenol
- Aliphatic electrophilic substitution: Preparation of Iodoform from ethanol and acetone.
- Aromatic Electrophilic substitution:Nitration: Preparation of m-dinitrobenzene, Preparation of p-nitroacetanilide or Halogenation: Preparation of p-bromoacetanilide Preparation of 2,4,6- tribromophenol.
- Diazotization/coupling: Preparation of methyl orange and methyl red.
- Oxidation: Preparation of benzoic acid from toluene.
- Reduction: Preparation of aniline from nitrobenzene, Preparation of m-nitroaniline fromm-dinitrobenzene.

3. Colorimetry

- To verify Beer-Lambert law $KMn0_4/K_2Cr_20_7$ and determined the concentration of the given solution of the substance.

4. Molecular Weight Determination

- Determination of molecular weight of a non-volatile solute by Rast method/Beckmann freezing point method.
- Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebulliscopy.

SIXTH SEMESTER

Function of Complex Variable

PAPER CODE: BSP 601 **CREDITS:** 3

Course Objective:
The main objective of Function of Complex Variable is to study the development of functions of one complex variable. Students will perform a thorough investigation of the major theorems of complex analysis – the Cauchy-Riemann Equations, Cauchy‟s Theorem, Cauchy‟s Integral Formula, the Maximum Modulus Principle, Liouville‟s Theorem, the Residue Theorem, Rouche‟s Theorem, the Riemann Mapping Theorem – including their proofs. They will also apply these ideas to a wide range of problems that include the evaluation of both complex line integrals and real integrals.

Course Contents:

Module I
De-Moivre‟s Theorem and its applications, Exponential, Sine, Cosine and Logarithm of a complex number, Inverse circular and hyperbolic functions. Complex Plane, connected and compact sets, extended complex plane: Stereographic projection. Complex valued functions,

Module II
Analytic functions, C-R equation, Harmonic functions. Construction of analytic functions, Line integrals and their properties, closed curve theorem for entire functions.

Module III
Cauchy's integral theorem, Cauchy's Fundamental theorem, Fundamental theorem of Integral Calculus for complex functions, Cauchy's Integral Formula, Analyticity of the derivative of an analytic function, Taylor expansions for entire functions, Liouville's theorem and the fundamental theorem of algebra.

Module IV
Singularities, Contour integration, Conformal mapping (Introduction), bilinear transformation and their simple properties, Power series.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

1. Complex Analysis , Purohit and Goyal , Jaipur Publishing House,2015
2. Complex Variables: Theory and Applications ,H.S.Kasana, Prentice Hall, Delhi,2005
3. Introduction to Complex Analysis, S.Ponnuswamy, Narosa Publishers,2011

References:

1. Theory and Problems of Complex Variables, R.Murray Spiegel , Schaum Outline Series,1974
2. Complex Variables and Application, Brown and Churchill, McGraw Hills Book Co.,2010

LINEAR ALGEBRA

Course Code: BSP 602 **Credit Units: 03**

Course Objective:

Linear algebra is the study of vector spaces and certain operators on vector spaces (called linear transformations). This is an important branch of mathematics which provides the tools and methods essential for studying many mathematical structures that arise within mathematics and sciences (such as the solution spaces of problems in mathematics, engineering, the natural sciences, and social sciences). The purpose of this course is to help students learn these tools and methods in a rigorous manner; develop mathematical skills needed to apply these to the problems arising within their field of study; gain increased understanding of how the concepts they learned in this and the previous mathematics courses apply to various real world problems.

Course Contents:

Module I

Linear Systems and Gaussian Elimination, Linear systems. Matrix representation of linear systems. Gaussian-Jordan elimination. Homogeneous linear systems. Row echelon form and the General solution. Row rank of a matrix and solution sets of homogeneous linear systems and general linear systems. Elementary matrices.

Module II

Linear Transformations, Definition and examples. Properties of linear transformations. Rank and kernel. The rank and nullity of a matrix. The matrix representation of a linear transformation. Change of basis. Isomorphism.

Module III

Orthogonality in Vector Spaces, Scalar products in R^n and C^n. Complex matrices and orthogonality in C^n. Inner product spaces. Orthogonality in inner product spaces. Normed linear spaces. Inner product on complex vector spaces. Orthogonal complements. Orthogonal sets and the Gram-Schmidt process. Unitary matrices.

Module IV

Eigenvalues and Eigenvectors, Eigenvalues and eigenvectors. Characteristic equation and polynomial. Eigenvectors and eigenvalues of linear transformations. Similar matrices and diagonalization. Triangolizable matrices. Eigenvalues and eigenvectors of symmetric and Hermition matrices.

Module V

Canonical Forms, Quadratic forms and conic sections. Quadrices. Bilinear forms. Minimal polynomials.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

1. V. Krishnamurthy, V. P. Mainra, J. L. Arora -An Introduction to Linear Algebra
2. D. T. Finkbeiner -Introduction to Matrices and Linear Transformation
3. S. Kumaresan - Linear Algebra; A Geometric Approach Prentice Hall of India, 2000
4. Shanti Narayan : A Course of Mathematical Analysis; New S. Chand & Co. Pvt. LId.
5. Titu Andreescu and Dorin Andrica, Complex Numbers from A to …. Z, Birkhauser, 2006.
6. E.J. Barbeau, Polynomials, Springer Verlag, 2003.
7. Joseph A. Gallian, Contemporary Abstract Algebra (4th Edition), Narosa Publishing House, New Delhi, 1999.
8. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory (2nd Edition), Pearson Education (Singapore) Pvt. Ltd., Indian Reprint, 2003.
9. David C. Lay, Linear Algebra and its Applications (3rd Edition), Pearson Education Asia, Indian Reprint, 2007.

Atomic and Molecular Spectroscopy

Paper Code :BSP603 Credit -02

OBJECTIVE:

This course aims to introduce various types of spectra for hydrogen, alkali and alkaline earth atoms. It also gives an introduction to X-ray spectra. Techniques of Molecular spectroscopy are also discussed in this paper, which include IR and Raman spectra.

MODULE I:

Introduction to Atomic Spectra

Types of spectra, spectrum of Hydrogen atom, spectral lines, the spinning electron, quantum numbers and their physical interpretation, quantum numbers for complete atom, magnetic moments of an atom and Landes 'g' factor, Larmor's theorem, Stern and Gerlach experiment, fine structure of the Hydrogen lines, spectral terms and their notation

MODULE II:

Spectra of alkali and alkaline atoms

Different series in alkali spectra, Ritz combination formula, spin orbit interaction, explanation of salient features of alkali spectra, doublet structure in alkali spectra (fine structure), Transition rules, intensity rules, spectra of alkaline earth metals, coupling schemes: L.S and j-j coupling, selection rules in atoms of two valence electrons, singlet and triplet series, spectrum of Helium atom.

MODULE III:

X-ray spectra

Continuous x-ray spectrum, characteristic emission and absorption spectrum and their explanation, energy levels, Moseley's law, combination principle, fine structure of x-ray lines, fluorescence yield and Auger effect, soft x-ray emission and structure of absorption edges.

MODULE IV:

Infra red spectroscopy (vibrational and rotational spectra)

Salient features of vibrational rotational spectra, vibrating diatomic molecules as a harmonic oscillator, fine structure of vibrational rotational bands, interaction of vibrational and rotational energies, experimental arrangements for studying IR spectra.

MODULE V:

Raman Spectra

Raman effect and its salient features, Observation of Raman spectra, classical theory of Raman effect, quantum theory of Raman effect, probability of energy transition in Raman effect, vibrational Raman spectra, Pure rotational Raman spectra, structure determination from Raman

and infra red spectroscopy.

ESSENTIAL READINGS:

1. “Elements of Spectroscopy”, Gupta, Kumar, Sharma, PragatiPrakashan, 2006.

2. “Fundamentals of molecular spectroscopy”, Collin N. Banwell and Elaine M. McCash, Tata McGraw Hill Publishing Company Ltd. New Delhi, 2005.

REFERENCES:

1. “Atomic Spectra and Atomic structure”, Gerhard Herzberg ,KreigerPub.Co.,Second Edition.
2. “Molecular Spectra and Molecular structure: Spectra of diatomic Molecules”, Gerhard Herzberg, Dover Publications.
3. “Introduction to Atomic Physics”, Enge, Wehr and Richards, Addison Wiesley, London.
4. “Atomic and Nuclear Physics”, A.B. Gupta, New Central book agency Pvt. Ltd.

NANO SCIENCE & TECHNOLOGY
Paper Code BSP604 Credit- 02

Objective:
This course aims at students to get acquainted with introductory knowledge of Nano science & technology.

Course Contents:

Module I: Introduction
Concepts of Nano (Feynmann), Classification of nanostructured materials, Nanoparticles, Quantum wire,Quantum well ,Quantum dots, Carbon nanotubes, Graphene, Nanowires, Ultra thin films- multilayered materials, Length scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties.

Module II: Preparation Methods
Bottom-up synthesis, Top-down approach: Mechanical milling, Sputtering, Evaporation.Material processing by Sol – Gel method, Chemical Vapour deposition and Physical Vapour deposition
,Microwave Synthesis of materials, Principles of SEM, TEM and AFM.

Module III: Characterization Techniques
X- ray diffraction technique, Scanning Electron Microscopy, Tunneling Electron Microscopy, Surface Analysis Techniques- AFM, SPM STM, ESCA.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- T. Pradeep, NANO The Essential, understanding Nanoscience and Nanotechnology, Tata McGraw-Hil Publishing Company Limited, 2007.
- Charles P.Poole Jr., Introduction to Nanotechnology, John Willey & Sons, 2003.
- Nanotechnology by Mark Ratner and Daniel Ratner, Pearson Education.

Nanomaterials by A.K. Bandyopadhyay; New Age International Publishers.

Physics Lab –VI
Paper Code : BSP605 Credit - 02

OBJECTIVE:

NOTE - Students are expected to perform any eight experiments from the given list. Two experiments out of the eight will be set in the examination paper.

1. Determination of Stefan's constant.
2. Determination of Planck's constant using a Photocell.
3. Determination of Planck's constant using a solar cell.
4. Study of power supply using two diodes/bridge rectifier with various filter circuits.
5. To perform various logic functions using NOR and NAND gates, i.e., OR, NOT, AND, NOR, NAND, X-OR gates.
6. To measure CMRR and input bias current and offset current using OP-AMP.
7. Study of characteristics of GM counter and verification of inverse square law for same strength of a radioactive source.
8. Study of absorption of β-rays in Aluminum foil using GM counter and to determine its absorption coefficient.
9. Determine ballistic constant of a ballistic galvanometer.
10. To determine self-inductance of a given coil by Anderson's bridge using AC.
11. To study Hall Effect and to determine Hall coefficient.
12. Application of operational amplifier as (a) inverting amplifier and (b) non inverting amplifier

Course: Bio-inorganic and Polymer Chemistry
Paper Code : BSP606 Credits: 02

Module I

Bioinorganic Chemistry: Essential and trace elements in Biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca.+2 , Mg+2 Nitrogen fixation

Module II

Silicones and Phosphazenes : Silicones :Phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.

Module III

Synthetic Dyes: Colour and constitution (electronic concept), Classification of dyes, Synthesis of Methyl orange, Congo red. Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo

Books Suggested:

1. Basic Inorganic Chemistry F.A. Cotton. G. Wilkinson and P.L. Gaus. Wiley.
2. Concise Inorganic Chemistry, J.D. Lee ELBS.
3. Concepts of Models Inorganic Chemistry B.Douglas. D.McDaniel and J.Alexander, John Wiley.
4. Inorganic Chemistry. D.E. Shriver P.W. Atkins and C.H. Langfor, Oxford.
5. Inorganic Chemistry, W.W. Porterfield Addison Wesley.
6. Inorganic Chemistry, A.G. Sharpe. ELBS.
7. Inorganic Chemistry, G.L. Miessler and D.A. Tarr, Prentice Hall.
8. Group Theory and Its Chemical Applications: P. K. Bhattacharya
9. Inorganic Chemistry: J. E. Huyee, Principles of Structure & Reactivity, 3rd Ed.
10. Selected Topics in Inorganic Chemistry: W. U. Malik, G. D. Tuli and R. Madan
11. Principles of Inorganic Chemistry: D. Banerje
12. Modern Aspect of Inorganic Chemistry: H. J. Emeleus and A. G. Sharpe

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Course: Bio-OrganicChemistry
Paper Code : BSP607 Credits: 02
Module I
Organic Synthesis via Enolates : Acidity of α Hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation, Keto-enol tautomerism of ethyl acetoacetate, Alkylation of 1, 3 - dithianes. Alkylation and Acylation of enamines
Carbohydrates: Classification and nomenclature monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening. of aldoses, Configuration of monosaccharides, Erythro and threo.diastereomers, Conversion of glucose into mannose. Formation of glycosides, ethers and esters, Determination of ring size of monosaccharides.Cyclic structure of D(+) glucose, Mechanism of mutarotation. Structure of ribose and deoxyribose, Anintroduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving strcture determination.
Module II
Amino Acids, Peptides, Proteins and Nucleic Acids: Classification, structure and stereochemistry of amino acids. Acid-base behaviour, is electric point and electrophoresis, Preparation and reactions of α - amino acids, Structure and nomenclature of peptides and proteins, Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides, Classical peptide synthesis, solidphase peptide synthesis. Structures of peptides and proteins, Levels of protein structure, Protein denaturation/renaturation, Nucleic acids: Introduction, constituents of nucleic acids. Ribonucleosides and ribonucleotides, the double helical structure of DNA
Books Suggested:

1. Organic Chemistry, Morrison and Boyd, Prentice Hall.
2. Organic Chemistry, L.G. Wade Jr. Prentice Hall.
3. Fundamentals of Organic Chemistry, Solomons, John Wiley.
4. Organic Chemistry Vol. I, II, III S.M. Mukerji, S.P. Singh and RP. Kappor, Wiley Eastern Ltd. (New Age International)
5. Organic Chemistry, F.A. Carey, McGraw Hill, Inc.
6. Introduction to Organic Chemistry. Streitwieser.heathcock and Kosover. Macmilan.
7. Organic Chemistry (Vol. I & II) : S. M. Mukherji, S. P. Singh and R. P. Kapoor, Wiley Eastern Ltd.
8. A Text Book of Organic Chemistry (Vol. I & II) : K. S. Tiwari, S. N. Mehrortra& N. K. Vishnoi
9. Organic Chemistry: M. K. Jain and S. Sharma
10. A Text Book of Organic Chemistry (Vol. I & II) : O. P. Agarwal
11. A Text Book of Organic Chemistry: R. K. Bansal
12. Organic Chemistry (Vol. I & II): I. L. Finar
13. Organic Reaction and Their Mechanisms: P. S. Kalsi
14. Introduction of Petrochemicals: SukumarMaiti,
15. Organic Chemistry: P. L. Soni
16. A Text Book of Organic Chemistry: V. K. Ahluwalia andMaduriFoyal, Narosa Publishing House Pvt. Ltd.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Elective Course: Heterocyclic Chemistry&Spectroscopy-II
BSP611 Credits: 03

Module I

Electromagnetic Spectrum : Absorption Spectra :- Ultra violet (UV) Absorption Spectroscopy - Absorption laws (Beer - Lambert law) molar absorptivity, presentation and analysis of UV spectra, types of electronic transition, Effect of conjugation, concept of chromophore and auxochrome, bathochromic, Hypsochromic, Hyperchromic and hypochromic shifts, UV spectra of conjugates and enones.

Infrared (IR) Absorption spectroscopy -

Molecular vibrations, Hooks Law, Selection rules, Intensity and Position of IR bands, Measurement of IR spectrum, Finger print region, Characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

Spectroscopy: Nuclear magnetic resonance (NMR) spectroscopy. (Proton Magnetic Resonance (HNMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spinspin splitting and coupling constant, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2 - tribromoethane, ethyl acetate, toluene and acetophenone, Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

Module II

Heterocylic 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 reactions in pyridine derivatives, Comparison of basicity of pyridine, piperidine and pyrrole, Introduction to condensed five and six-membered heterocyles. Preparation and reactions of indole, quauinoline and isoquinoline with special reference to Fisher Indole synthesis, Skraup's synthesis and Bischler-Napieralski synthesis, Mechanism of electrophilic substitution reactions of indole, quinolone and isoquionoline.

Module III

Electronic Spectra of Transition Metal Complexes: Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel-energy level diagram for d1 and d9 states, discussion of the electronic spectrum of $[(Ti(H_2O)_6)^{3+}$ complexion. Thermodynamic and Kinetic Aspects of Metal Complexes: A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

Books Suggested:

1. Organic Chemistry, Morrison and Boyd, Prentice Hall.
2. Organic Chemistry, L.G. Wade Jr. Prentice Hall.
3. Fundamentals of Organic Chemistry, Solomons, John Wiley.
4. Organic Chemistry Vol. I, II, III S.M. Mukerji, S.P. Singh and RP. Kapoor, Wiley Eastern Ltd. (New Age International)
5. Organic Chemistry, F.A. Carey, McGraw Hill, Inc.
6. Introduction to Organic Chemistry. Streitwieser.heathcock and Kosover. Macmilan.
7. Organic Chemistry (Vol. I & II) : S. M. Mukherji, S. P. Singh and R. P. Kapoor, Wiley Eastern Ltd.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

CHEMISTRY LAB-VI

BSP608 **Credit 2**

NOTE: Students are expected to perform any eight experiments from the given list. The duration of the Practical Examination shall be 4 hours. The distribution of marks in the practical examination will be as follows:

1. Three experiments: 20 Mark each.
2. Distribution of marks will be as follows:
   - Figure /Formula/Theory : 5
   - Observations/Calculations : 8
   - Result /Result Analysis : 5
   - Precautions : 2
3. Viva -Voce : 10

List of Experiments:

1. Instrumentation

2. Colorimetry:
   - Mole-ratio method
   - Adulteration-Food stuff.
   - Effluent analysis - water analysis.
   - Solvent Extraction: Separation and estimation of Mg(II) and Fe(II)
   - Ion Exchange Method: Separation and estimation of Mg(II) and Zn(II)

3. Volumetric Analysis: Iodimetric&Iodimetric titrations.
4. Laboratory Techniques
   - Steam Distillation: Naphthalene from its suspension in water, Clove oil from Clove, Separation of o-and p-nitrophenols
   - Column Chromatography: Separation of fluoressein and methylene blue. Separation of leaf pigments from spinach leaves. Resolution of racemy mixture of (z) mandelic acid.

5. Qualitative Analysis: Analysis of an organic mixture containing two solid components using water, NaHCO3, NaOH for separation and preparation of suitable derivatives.
6. Stereochemical study of Organic Compounds via Models R and S configuration of optical isomers. E, Z configuration of geometrical isomers, Conformational analysis of cyclohexanes and substituted cyc1ohexanes
7. Organic estimation, Amino group, Phenolic group, Carboxylic acid and Glucose.
8. Electrochemistry
   - To determine the strength of the given acid condcutometrically using standard alkali solution.
   - To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrical.
   - To study the saponification of ethyl acetate conductometrica1ly.
   - To determine the ionization constant of a weak acid conductometrically.
   - To titrate potentiometrically the given ferrous ammonium sulphate solution using $KMn0_4/K_2Cr_20_4$ as titmate and calculate the redox potential of Fe^{++}/Fe^{+++} system on the hydrogen scale.

9. Refractometry, Polarimetry

   - To verify law of refraction of mixtures for ego of glycerol and water) using Abe's refractometer.
   - To determine the specific rotation of a given optically active compound.

Books suggested (Laboratory Courses):

1. Vogel's Qualitative inorganic analysis, revised, SveWa, Orient Longman.
2. Vogel's Text Book of Quantitative Inorganic Analysis (revised), J. Bassentt. RC.Deney G.H. Jeffery and J. Mendham.ELBS.
3. Standard methods of chemical Analysis. W.W. Scott. The technical Press.
4. Experimental Inorganic Chemistry, W.G. Palmer, Cambridge.
5. Handbook of Preparative Inorganic Chemistry. Vol I & II, Braver, Academic Press.
6. Inorganic Synthesis, McGraw Hill.
7. Experimental Organic Vol I & II, P.R Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
8. Laboratory manual in Organic Chemistry, RK. Bansal, Wiley Eastern.
9. Vogel's Text Book of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V.Rogers, P.W.G. Smith and A.R Tatchell, ELBS.
10. Experiments in General Chemistry, C.N.R Rao and U.c. Agarwal, East-West Press.
11. Experiments in Physical Chemistry, RC. Das and B.Behra, Tata McGraw Hill.
12. Advanced Experimental Chemistry, Vol I Physical, J.N. Gurtu and R Kappor, S Chand & Co.
13. Selected Experiments in Physical Chemistry, N.G. Mukerjee, J.N. Ghose& Sons.
14. Experiments in Physical Chemistry, J.C. Ghosh, BharatiBhavan.
15. Practical Chemistry: GiriBajpai and Pandey, S. Chand & Co. Ltd., New Delhi

Open Elective - Physics

DIGITAL ELECTRONICS AND COMMUNICATION

Paper Code : BSP410 Credit Units: 03

Course Objective:

This course aims at exposing the students to Digital Electronics and Communication.

Course Contents:

Module I: Combinational Logic

Boolean Algebra, Logic systems, Circuits for OR, AND, NOT gates, transistor switching times, Exclusive OR gate, De Morgan's laws, Verification and design of AND, OR, NOT and XOR gates using NAND gates to design, a combinational logic system for a specified truth table to convert a, To minimize a given logic circuit, To study TTL ICs (binary decoder, 7segment decider, Schmitt trigger), Design a 7-segment display driver.

Module II: Arithmetic and Logic Units

Half adder, full adder, and 4 bit binary adder,Half substractor, full subtractor, adder subtractor using full adder IC.

Module III: Flip-Flops, Counters, Shift Registers and Converters:

Build a flip flop circuits using elementary gates (RS, clocked RS, D-type, JK),Build a 4 bit counter using D-type JK flip-flop, Make a shift register from D type flip-flop, Serial and parallel shifting of data, A/D converter, D/A converter.

Module IV: Communication

Modulation and detection, AM, FM, Radio wave propagation, Radio transmitter and receiver, TV receiver, Pulse Modulation, Modem, Operation Amplifier (OP-AMP).

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Pulse, Digital and Switching Waveforms : J. Millman and H. Taub (Tata Mcgraw Hill)
- Electronic Devices and Circuits: A. Mottershead (Prentice Hall).
- Electronics Fundamental and Application: D. Chattopadhyay and P.C. Rakshit.

LASER PHYSICS

Paper Code BSP510 Credit Units: 03

Course Objective:
This course aims at students to give them basic understanding of Laser and its applications.

Course Contents:

Module I: Introduction
Introduction, mono chromaticity, temporal and spatial coherence, Einstein's coefficients, momentum transfer, possibility of light amplification, kinetics of optical absorption, shape and width of spectral lines, line broadening mechanism, natural, collision and Doppler broadening.

Module II: Laser Pumping and Resonators

Resonators, modes of a resonator, number of modes per unit volume, open resonators, confocal resonator (qualitative), quality factor, losses inside the cavity, threshold condition, Quantum yield.

Module III: Dynamics of the Laser Processes

Rate equations for two, three and four level systems, production of a giant pulse – Q switching, giant pulse dynamics, laser amplifiers, mode-locking, hole burning, distributed feedback lasers.

Module IV: Types of Lasers

He-Ne laser, Nitrogen Laser, CO_2 laser, Ruby laser, features of semiconductor lasers, intrinsic semiconductor lasers, doped semiconductors, condition for laser action, Advances in semiconductor lasers, injection lasers, dye lasers.

Module V: Applications

Holography, non-linear optics: harmonic generation, second harmonic generation, phase matching and optical mixing, brief qualitative description of some experiments of fundamental importance.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

- Lasers and Non-linear Optics: B.B. Laud. (Wiley Eastern).
- Principles of Lasers: O. Svelto (Plenum Press).
- An Introduction to Lasers and their applications: D.C.O'Shea, W. Russell and W.T.Rhodes (Addition –Wesley).
- Laser Theory and Applications :Thyagarajan and A. Ghatak (MacMillan)

ATMOSPHERIC PHYSICS

Paper Code : BSP Credit Units: 03

Course Objectives:

Several fundamental aspects related to Physics, Thermodynamics and Chemistry of the Atmosphere and Oceans will be introduced to the students in order to make them understand, and apply the knowledge to the physico-chemical processes that influence the weather and climate.

Course Contents:

Module I: Thermodynamics

Thermodynamics of dry and moist air, atmospheric stability and dry adiabatic lapse rate, moist processes in the atmosphere, saturated and unsaturated ascent, moist adiabatic and saturated adiabatic processes in the atmosphere, saturated adiabatic lapse rate, pseudo adiabatic processes and equivalent potential temperature, conditional instability second kind, moist convection, aerosols, condensation processes, formation of cloud droplets, precipitation.

Module II: Ocean Morphology

Ocean physics, thermodynamics of sea water, observed temperature, salinity, and density in the ocean, density stratification, water mass distribution, coastal currents and upwelling, thermohaline circulation. Oceans currents, coupling of surface and deep ocean waters, basic foundation of turbulence, turbulent flows, turbulent vorticity, turbulence pressure, eddy diffusivity, coherent structures, surface fluxes, air-sea interaction, mixing processes in the ocean.

Module III: Earth-Atmosphere Radiation Balance

Radiative transfer in atmosphere and ocean: Sun and climate, Planck function, black-body radiation, local thermodynamic equilibrium, radiometric quantities, absorption and emission, Schwarzchild's equation, radiative equilibrium in a grey atmosphere, balance between incoming solar and outgoing thermal radiation, role of aerosols, absorption by atmospheric gases, heating rates, net radiative heating, Radiative transfer in atmosphere-ocean system.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

A-Attendance; **CT**-Class Test; **S/V/Q**-Seminar/Quiz/Viva; **HA**-Home Assignment; **EE**-End Semester Examination

References

(i) The Solid Earth: An Introduction to Global Geophysics [Paperback] C. M. R. Fowler, Cambridge University Press, 1990.

(ii) Climate and the Oceans, Ed. Geoffray K. Vallies, Princeton University Press, 2012.

(iii) **Ocean Circulation: Wind-Driven and** Thermohaline Processes, Ed. RuiZin Huang,

Cambridge University Press, 2009.

SEMINAR

BSP : 640 **Credit Units: 03**

Guidelines for Seminar

a) Choosing the topic
b) Finding relevant materials
c) Presentation
d) Response to queries
e) Submission of the write up

Presentation of the seminar will be of 30 min maximum (25 min presentation and rest question answer session)

Examination Scheme:

Components	Weightage
Content	30
Presentation	40
Response to the queries	20
Write up	10

DOMAIN ELECTIVES

NUMBER THEORY

Course Code: BSP 409 **Credit Units: 04**

Course Objective:

Number theory is an important area of study in Mathematics. Without the knowledge of the beviour of various numbers and their properties, the study of Mathematics is in a way is meaningless. The purpose of this course is to teach students various concepts that have been used to study and apply in coding theory, cryptology besides in algebra and analysis.

Course Contents:

Module I

Euclid‟s division lemma, Divisibility, The Linear Diophantine Equation, The fundamental theorem of Arithmetic, Fermat‟s Little theorem, Wilson‟s Theorem, Generating functions, Basic Properties of Congruences, Residue Systems, Linear Congruence, The Theorems of Fermat and Wilson Revisited, The Chinese Remainder Theorem, Polynomial Congruences.

Module II

Combinatorial Study of $\varphi(n)$, Formulae for $d(n)$ and $\sigma(n)$, Multiplicative Arithmetic Functions, The Mobius Inversion Formula, Properties of Reduced Residue Systems, Primitive Roots Modulo p, Elementary properties of $\Pi(n)$, Tchebychev‟s Theorem.

Module III

Euler‟s Criterion, the Legendre Symbol, The Quadratic Reciprocity Law, Applications of the Quadratic Reciprocity Law, Consecutive Residues and Non-residues, consecutive Triples of Quadratic Residues.

Module IV

Sum of Two Squares, Sum of Four Squares, Euler‟s Partition Theorem, Dirichlet‟s Divisor Problem.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

1. George E. Andrews: Number Publishing Corporation Theory, Hindustan (India).
2. Niven, I., Zuckerman, S.H., Montgomery, L.H., An Introduction to the Theory of Numbers, John Wiley and Sons. New York
3. Flath J., Introduction to Number Theory.
4. Ireland & Rosen, A Classical Introduction to Modern Number Theory, Springer Verlage.
5. Cassels, J.W.S., Frolich, A., Algebraic Number Theory, Cambridge University Press, London

Partial differential equations

Course Code: BSP 507 **Credit Units: 03**

Course Objective:

Upon completing the course, the student will be familiar with the modeling assumptions and

derivations that lead to PDEs, know and recognize the major classification of PDEs, understand the qualitative differences between the classes of equations, and be competent in solving linear PDEs using classical solution methods. This course should serve as a good vehicle for students to acquire experience with an integrated computational environment that includes tools for solving differential equations, data analysis, and visualization. A background in ODEs and some basic knowledge of linear algebra is required.

Course Contents:

Module I

Introduction, classification, construction and geometrical interpretation of first order partial differential equations (PDE), method of characteristic and general solution of first order PDE, canonical form of first order PDE, method of separation of variables for first order PDE. Charpit‟s Method, Jacobis Method, Jacobi method to solve a non linear first order PDE in two variables

Module II

Linear PDE with constant coefficient, solution of homogeneous linear PDE with constant coefficient solution of non homogeneous PDE with constant coefficient, Irreducible PDE, PDE of Euler Cauchy Type.

Module III

Cauchy problem for second order PDE, homogeneous wave equation, initial boundary value problems, non-homogeneous boundary conditions, finite strings with fixed ends, non homogeneous wave equation, Riemann problem, Goursat problem, spherical and cylindrical wave equation. Monge‟s Method for solving PDE of order two with variable coefficient.

Module IV

Method of separation of variables for second order PDE, vibrating string problem, existence and uniqueness of solution of vibrating string problem, heat conduction problem, existence and uniqueness of solution of heat conduction problem, Laplace and beam equation, non-homogeneous problem.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

1. Gockenbach, M. S., Partial Differential Equations: Analytical and Numerical Methods, 2002.
2. Courant, R. and D. Hilbert, Methods of Mathematical Physics, Volume I, 1991.
3. Strang, G., Introduction to Applied Mathematics, 1986.
4. S. J. Farlow, Partial Differential Equations for Scientists and Engineers
5. Richard Haberman, Applied Partial Differential Equations.

GAME THOERY

PAPER CODE: BSP610 **CREDITS:** 3

Course Objective:

In this course on game theory, we will be studying a range of mathematical models of Conflict and cooperation between two or more agents. This course is an introduction to game theory and strategic thinking. Ideas such as dominance, backward induction, Nash equilibrium, evolutionary stability, commitment, credibility, asymmetric information, adverse selection, and signalling are discussed and applied to games played in class and to examples drawn from economics, politics, the movies, and elsewhere.

Course Contents:

Module I

Concept of Game problem. Rectangular games. Pure strategy and Mixed strategy. Saddle point and its existence. Optimal strategy and value of the game.

Module II

Necessary and sufficient condition for a given strategy to be optimal in a game. Concept of Dominance, Fundamental Theorem of Rectangular games, Algebraic method, Graphical method and Dominance method of solving Rectangular games. Inter-relation between the theory of Games and L.P.P

Module III

Formulation of two person zero sum games, solving two person zero sum games, Dynamic Games with complete information – Extensive games, Backward Induction, Applications, Extensive form representation of games, Sub game Perfect equilibrium, Repeated Games and more applications.

Module IV

Static Games of incomplete information – Bayesian Games, Bayesian Nash Equilibrium Applications, Dynamic Games with complete incomplete information – Perfect Bayesian Equilibrium, Signaling Games and Applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

1. Roger B. Myerson (1991). Game Theory: Analysis of Conflict, Harvard University Press, p. 1. Chapter-preview links, pp. vii-xi.
2. R. J. Aumann ([1987] 2008). "game theory," Introduction, The New Palgrave Dictionary of Economics, 2nd Edition.Abstract.
3. Colin F. Camerer (2003). Behavioral Game Theory: Experiments in Strategic Interaction, pp. 5-7 (scroll to at 1.1 What Is Game Theory Good For?).
4. Ross, Don. "Game Theory". The Stanford Encyclopedia of Philosophy (Spring 2008 Edition). Edward N. Zalta (ed.). Retrieved 2008-08-21.